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Pity the Poor Railroad

A RECENT editorial plaint in the Baltimore *Sun* is a sample of the type of economics imposed by the public on the railroads. It appears that while some improvements are being made in the tunnel near the present station, freight traffic is being diverted around the city. The *Sun* very promptly asks whether the change foreshadows the diversion of part of the passenger traffic, adding that Baltimore cannot tolerate the curtailment of its passenger-train accommodations. It might lessen the stopping off of through passengers! The adequacy of the service and the railroad's return on its investments apparently do not interest the *Sun*. Let the stockholder hold the bag. And lest this attitude be thought a mere whim of the journal in question, let it be said that to prevent just such a diversion the Maryland Legislature passed a law some years ago prohibiting the railroad from building a cutoff within 16 miles of the city. Truly the railroad is the public clown. How else account for the antics it is made to perform?

Who's Who at Conventions

A DETAIL to which local committees in charge of convention arrangements may well give heed is the convention badge. The general practice is to give each member a numbered badge. A much better system, which is occasionally adopted, is to have the member's name on the badge. The numbering of delegates robs a meeting of the personal touch which can be secured by using names. One of the prime objects of all such gatherings is to promote social intercourse, and in a national association, where members congregate from widely separated sections, men do not always have a wide personal acquaintance. They may, however, know one another by reputation, and if a man carries his name on his badge he may be readily approached by those who wish to meet him. The mere fact of carrying the name displayed also makes for greater cordiality, the feeling being that the badges are an indication that formal introductions are not necessary.

No Pump House in Park

THIS week's developments in the controversy over the erection of a pump house above one of the Catskill aqueduct shafts within the limits of Morningside Park, New York City, indicate that the structure will be placed underground. Its proposed location on the surface in the park area occasioned a storm of protest from the press, civic bodies and individuals. Deeming the matter of civic importance, the American Institute of Consulting Engineers appointed a committee, headed by William J. Wilgus, to investigate and report on the question. Its findings indicated that a subsurface pump structure was feasible, and it is probable that the committee of the Board of Estimate and Apportionment which has this matter under consideration will advocate this solution to the problem. Of course the underground structure will involve a greater cost than the one originally planned—$50,000 or more. Nevertheless it is believed that the payment of this sum is preferable to an invasion of an area set aside for park purposes. Then, too, the building of the station above ground would set a dangerous precedent. The outcome is in accordance with the Engineering Record's opinion, expressed in a previous issue, as to the undesirability of encroaching on park lands. If no other solution than a pump house above ground were possible public necessity might have justified the original plan. There appears to be no doubt, however, that the subsurface station is feasible. Under these circumstances there should be no encroachment upon the park area.

Arbitration vs. Suits

ARBITRATIONS of disputes arising over engineering contracts involving private parties are so common as to excite no comment among engineers. With increasing frequency disputes involving the public and public-service corporations are being settled in the same way. The Engineering Record has called attention to several such cases, and in this issue Farley Gannett tells of the satisfactory settlement of a public-service case which had already gone to the state supreme court and had been ordered retried. In two months the board settled what the courts had failed to determine during the course of two years of litigation. Mr. Gannett points out that arbitration in such cases offers a speedy and satisfactory settlement where the jurisdiction of public-service commissions does not apply. This is not disputed, but attention is called to the fact that at least one public service commission is conducting its work, when decisions depend entirely or largely upon engineering facts, in the same spirit as the arbitration that Mr. Gannett describes. Engineering hearings are held at which the engineer of the commission presides and acts as arbitrator. The conclusions usually are reached by unanimous agreement. When there are points about which no agreement can be reached they are specified in the detailed report to the commission. The advantage of such a procedure is obvious. It does not in any way change the policy or theory of the case held by the attorneys of either side and the briefs and arguments of attorneys proceed before the commission, after the engineers' conference is finished, in the usual way. Contestants who have appeared before the commission in cases where the procedure has been handled in this way have said that the presentation of their cases has been very much facilitated. The commission likewise has saved time. The practice deserves wider adoption.

Larceny

PROTEST against the stealing of engineers' ideas by other engineers and by manufacturers is heard with too great frequency. Generally there is no remedy at law, so that the only hope for a lessening of the practice lies in raising the general level of the profession and of the business ethics. Periodical public protests, however, may help to shame those who deliberately filch from others. Of recent instances there come to mind imitation of a novel and successful water-softening plant, the appropriation of details from designs submitted by a builder of turbines and the use of some special apparatus designed for sewage treatment. Each one can lengthen the list from his own experience. Of course, there is another angle of this matter—that advancement of the race demands that more efficient devices and methods be applied as rapidly as practicable. To accept the old when there is better available is not only a mark of incompetence but a brake on progress. More fundamental than that broad consideration, however, is the principle that the laborer is worthy of his hire, that a man should receive the reward of his discovery and his efforts. Jones cannot cite in his defense for appropriating Smith's method that it would be an injustice to his client to use an obsolete process. The proper procedure is to call Smith into consultation and let him profit by his skill. Another phase of the question is that it is usually economical to come to the originator of a device for help. In two of the cases cited above the designs were purloined bodily and applied to conditions where they did not exactly apply. In one case there was a partial failure; in the other, a wise client took the precaution to consult the originator and saved himself from certain loss. Manifestly the principle of respect for another's development must be applied with judgment. To draw no lessons from the experiences of others would be death to progress. In reinforced concrete, for example, the little developments here and there brought about the rapid advance. The true gentleman will have no difficulty in telling how far he may go and when he should consult with, or at least give credit to, the originator.

Gasoline and Sewer Explosions

INSOFAR as the civil engineer's work is concerned the tremendous increase in the use of motor vehicles during the last few years has had its most marked effect in the field of road building, but there is another phase of the motor situation, not so important, to be sure, but still of enough consequence to place a new obligation upon municipal engineers. Every now and then a section of some large city is shaken by an explosion in its sewerage system. Lives of pedestrians are endangered by manhole heads popping skyward, pavements are cracked, window panes broken and sewer walls shattered. It has been pretty clearly shown that such explosions are traceable directly to the presence of gasoline vapor. Garages are the chief source of trouble, though dry-cleaning establishments, where large quantities of naphtha are used, are also to blame.

Not long ago Pittsburgh experienced two serious sewer explosions, and an investigation of their causes was undertaken by the U. S. Bureau of Mines, co-operating with the municipal authorities. The results of this study have just been published in Technical Paper 117, by G. A. Burrell and H. T. Boyd of the Bureau of Mines. The tests were made in a sewer 8 ft. 3 in. wide and 8 ft. 6 in. high, tapped by six manholes. Gasoline was dumped into the sewer at the upper manhole and tests of the sewer air were made between that point and the outlet into the Allegheny River, 2706 ft. distant. As a general rule, according to the report, 1.5 per cent of gasoline may be fixed as the low explosive limit of mixtures of gasoline vapor and air. The results of the tests indicate that one barrel (55 gal.) of gasoline dumped at once into the sewer, in which the flow was 19.6 sec.-ft. and the velocity 6½ ft. per second, caused the formation of an explosive mixture for only a few minutes at any given point. The largest quantity of gasoline vapor in any sample was 2.19 per cent at manhole 3. When a barrel of gasoline was poured into the sewer at the rate of 5 gal. per minute, instead of being dumped, as in the first test, the highest percentage of gasoline vapor 2 ft. above the water surface was 0.70 per cent. The highest percentage 2 in. above was 1.67 per cent. Thus at certain periods, and at points 2 in. above the water, explosive atmospheres existed, but 2 ft. above the water the atmospheres were not explosive.

When the sewer was bulkheaded, to simulate conditions that would prevail if the outlet were submerged, a dangerous condition resulted from dumping into the sewer at one point one barrel of gasoline at the rate of 5 gal. per minute. At some places a dangerous atmosphere continued for 5 hours. This result, of course, is attributable to the slowing up of the flow. Repeating this test with only one-half barrel of gasoline, admitted at a 5-gal.-per-minute rate, there did not result at any time a dangerous condition except during the first 15 minutes.

While the report does not contain any recommendation concerning the prevention of sewer explosions, the information it carries should be of considerable interest to municipal engineers charged with the maintenance of sewerage systems.

Engineering at the Front

THE half has not yet been told of the service of the engineer in the present warfare along the western front. In fact, the success of military operations there depends on intensive transportation, most of it of a temporary character. The Germans, as is well known, had their military railroads thoroughly prepared as far as the Belgian and French frontiers, with numerous lines reaching this territory and expanding into branches with elaborate unloading facilities, so that at the first moment of war men and material could be spread out quickly along the whole front. The Allies had much smaller resources of this kind and have had to organize them since the outbreak of hostilities. It is reported on good authority that along the British front alone hundreds of miles of light railway have been laid on temporary roadbeds sometimes hardly more than superficial, to enable rapid transportation of troops and supplies. These lines connect at every available point with the French railway system and serve as feeders for the wonderfully perfect motor transport system between their termini and the firing lines. Just how the work has been organized is at present a military secret, but that it has been done thoroughly recent events plainly show. When a soldier at the front "somewhere in France" can be regularly supplied with clean clothes from his London home month in and month out, it shows what organization and engineering have been able to do for the British system of transport.

One is tempted to inquire how long it would take to accomplish a similar feat in this country, where railroading, in the ordinary sense, is really a national specialty. As part of the general preparedness campaign, in which American engineers have taken so great an interest, provisions should be made to follow the example thus set. Here is a magnificent opportunity for co-operation between the practical transportation engineers and the government, if that slow-moving organization is capable of efficient co-operation. The British military railways stop out of shell range of the hostile front, and from that point on tractors and motor trucks take up the burden. It is well known that some of the very best of these have come from America, but what effort has been made to plan for motor vehicles especially adapted to the somewhat more difficult American conditions? That material comparatively standard has been able to do good work in the little affair of supplying General Pershing's force is small comfort, for the transportation required for a few regiments and light field batteries is a bagatelle compared with that demanded for fifty divisions or more, and artillery massed to an extent that never has been even approximated in any previous war. We need, and we need badly, the earnest efforts of the automobile engineers in planning for the production when necessary, from standard parts as far as possible, of a full equipment of motor trucks and tractors for heavy pieces specially designed to meet the requirements of country near the American coast, as well as along its frontiers. It is just such planning that is expected of the Industrial Preparedness Committee of the Naval Consulting Board. The success of any campaign against America, by whomsoever conducted, depends chiefly on the quickness and power of the first blow, and this as a rule comes, as it came two years ago, almost without warning.

The aeroplane engineer, too, needs to wake up and come to the front. Considering the fact that the conquest of the air was fundamentally an American achievement it is not cheerful when one of the few great masters of the art in this country openly confesses that by the time he gets a new idea into construction it is, from a foreign point of view, antiquated. Along the Mexican frontier we need aeroplanes by the score for scouting purposes, yet the observer in charge of the army service reports that it is extremely difficult to get suitable propellers for the few machines which the government has, the standard forms not being adapted to stand up in hot climates. It is quite safe to say that the government does not possess a single plane equipped with effective bomb-dropping apparatus, with a proper machine gun emplacement or armored even enough to protect the driver and observer from casual musketry, let alone from machine guns and shrapnel. In the next war aeroplanes will play even a greater part than now, not only in scouting and fighting, but even in supply. Had the British in Mesopotamia had half a dozen planes of large carrying capacity, which could perfectly well be produced, Kut-el-Amara might not have been starved out.

It is high time to wake up and muster the engineering skill of the country to the point at least of quiet preparations for efficient action. The work of the Naval Consulting Board shows that laymen are ready to do their part.

The Engineer's Interest in Political Economy

ENGINEERS are apt to forget, in the hurry of designing and building, the means by which society produces its wealth. They are more directly concerned with that production than almost any other class of men. It is refreshing, therefore, when the retiring president of so influential an organization as the Engineers' Club of Philadelphia sees fit to pass by, in his last official message to the members, all that has to do with the immediate business of increasing the amount of wealth produced for a given effort, and to direct attention to the interest engineers ought to take in what becomes of that wealth after it is produced.

It is often held that the distribution of wealth, as affected by matters like the public ownership of natural resources, is a political and economic question about which engineers, being merely organizers and creators of means for producing wealth, do not need to worry. Engineers, however, are personally concerned, in common with everyone else, over the distribution of wealth. They are, moreover, vitally interested in that distribution because they are engineers. The volume of wealth turned into producing capital directly limits the activities and accomplishments of the profession. The order and manner in which the natural resources of the country are developed dictate at present the lines along which the engineer must work. The engineer might, under different economic conditions, increase the production of wealth at a much greater rate and on a more sound basis if he himself had the power to determine the extent and direction of the development of these natural resources. The problem requires engineering ability for its solution.

While Mr. Ledoux's address may seem far afield to some—and the Engineering Record remarks, in passing, that it is not in sympathy with all of Mr. Ledoux's opinions—the subjects with which he deals are those that the engineer must take up if he is to realize the possibilities that lie before him.

The Elusive Elastic Limit

THE DISCUSSION of the relation between yield point and proportional limit of steel at the recent meeting of the American Society for Testing Materials, abstracted on page 78 of last week's issue, serves to call attention anew to the present deplorable lack of agreement as to how the term "elastic limit," or its numerous variants, should be defined, and how its value should be determined. However illuminating and suggestive that discussion proved in other respects, nevertheless, insofar as the particular features under consideration are concerned, it has only served to emphasize the previous confusion. That criticism applies in some measure also to the report of Committee E1, on standard methods of testing, presented at the same meeting. That committee has offered the following three definitions, which, upon approval by letter ballot, will be embodied in the A. S. T. M. Standard Methods for Testing:

1. "Elastic Limit is the greatest load per unit of original cross-section which does not produce a permanent set."
2. "Proportional Limit is the load per unit of original cross-section at which the deformations cease to be directly proportional to the loads."
3. "Yield Point is the load per unit of original area at which a marked increase in the deformation of the specimen occurs without increase of load."

Definitions 1 and 2 are followed by the explanatory note: "This determination is rarely made in the commercial testing of materials."

In the present A. S. T. M. Standard Methods the foregoing definition for "proportional limit" is used to define the "elastic limit," although it is stated elsewhere that the *real* elastic limit is that covered by the first of the above three definitions. In the topical discussion previously alluded to, Mr. Howard made the statement, apparently at variance with many existing records, that "the behavior of steel is generally such that the elastic limit and proportional limit coincide"; also that the term yield point "does not appear to have any fixed meaning," an assertion which, though measurably justified for materials possessing no true yield point, is seemingly unwarranted for the general run of structural steel.

The Engineering Record submits that it is imperatively incumbent upon Committee E1 to seek to bring early order out of this chaos, insofar, at least, as the practical requirements of specifications for materials are concerned. The scientific phases of the problem, which are incomparably more exacting and perplexing, may well be left for mature subsequent consideration. In any future report on these features it is to be hoped that the committee will offer, in support of its findings, authoritative test data from published records or its own independent researches.

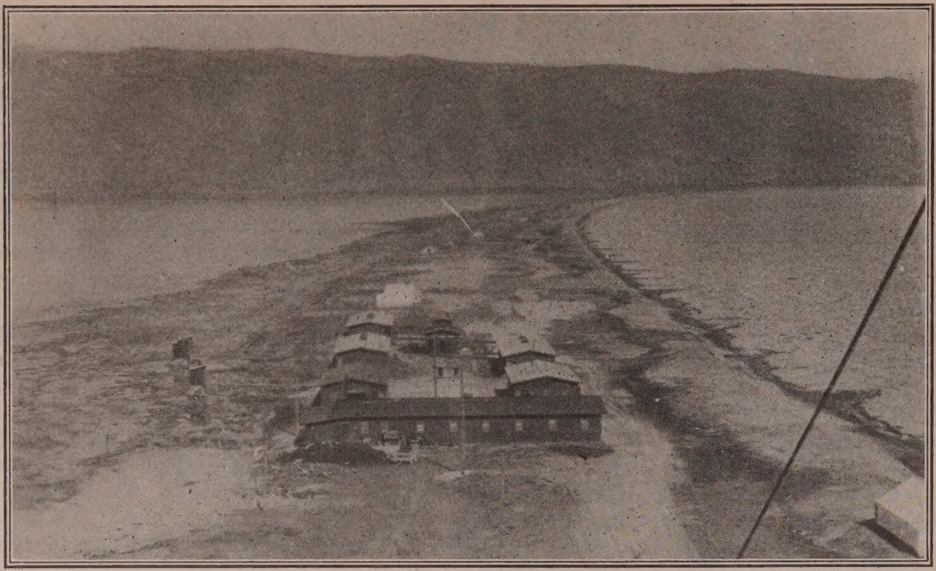
Limiting ourselves to the practical aspects of the existing situation, the proposed new definition for elastic limit, though concededly correct in a strict but narrow scientific sense, is open to certain serious objections: First, in that the values would be greatly affected by the gage length and the sensitiveness of the measuring apparatus; second, that if both these elements could be standardized, there would still be no escape from the effect of initial stresses and nonhomogeneity in the material, from which practically no material is exempt, not to mention other important disturbing influences alluded to in Professor Moore's discussion. Evidence is, in fact, not lacking which would point logically to the conclusion that ferrous metals, loaded for the first time after leaving the finishing rolls, will exhibit "set" under the smallest initial load, if only the measuring apparatus is sufficiently delicate for its detection. That circumstance, together with the extreme slowness of the test, and the fact that the resulting values would apparently have no recognizable physical significance, would inevitably tend to discredit this definition for practical purposes. Its acceptance would, in effect, remove the term elastic limit from engineering literature and relegate it to purely scientific uses.

The committee cannot keep the thought too prominently in view that it is, after all, the *physical significance* of the results in which the interest of engineers is centered. Engineers cannot be expected to prescribe, and manufacturers cannot afford to adopt, refined and time-consuming methods unless it can be convincingly shown that the results to which they lead have a physical significance of superior value, and that they cannot be obtained within adequate limits by simpler and quicker means. If that can be made evident, a suitable readjustment in commercial testing would necessarily follow. In the meantime it would seem ill-advised to put forward an impracticable definition for a thing whose practical value is, to say the least, unproved.

It is hardly to be doubted that the term yield point in the sense in which it is defined by Committee E1, which makes it applicable only to materials possessing a true yield point, will long remain the principal reliance in practical elastic strength determinations for such materials. This definition has, moreover, the merit of being in strict accord with the use of that term throughout the A. S. T. M. specifications wherein its determination by the drop of the scale-beam is in every instance explicitly prescribed, this method being feasible, of course, only for materials which have a true yield point. For other materials, for which this term becomes a misnomer, it would seem wise, from a practical viewpoint, for the committee to follow the lead of the Subcommittee on Methods of Tests of Committee A1, on steel, which, it may incidentally be observed, is under the same chairman, Professor Lanza, by defining the elastic limit as that load per unit of original cross-section at which the rate of elongation shows a sudden increase as seen by observations on a suitable extensometer. This would also avoid an impending glaring inconsistency in the revised A. S. T. M. standards, and would mean substantially a return, for the definition of elastic limit, to the proposed definition for proportional limit, a term not now recognized in any of the A. S. T. M. specifications. The elastic limit, as thus defined, offers the important advantage that it can be found with comparative ease and speed, and with sufficient accuracy for practical purposes, without stoppage of the testing machine, if the pulling speed is kept within proper limits, as has been shown by experience in a number of leading commercial and research laboratories.

In this way it is believed satisfactory provision would be made for the only two terms relating to elastic strength—namely, yield point and elastic limit—which figure in present-day specifications, and in a manner entirely consistent with the revised A. S. T. M. standards for materials. While the term elastic limit, in the sense here advocated, might perhaps more logically be supplanted by the term proportional limit, as suggested by Major Morse, such an attempt at abandoning a term so long established would inject an added element of complication which it would seem desirable to avoid.

As a better ultimate solution for commercial purposes, it is hoped that a simple apparatus will yet be developed which will yield a graphic record of the average deformations on opposite sides of the test specimen and the corresponding loads. This would serve to establish both the proportional limit—under whatever name—and the yield point. While the relative importance of these two physical constants cannot yet be definitely stated, enough is known to indicate that each has its individual practical significance for particular purposes, and that jointly they serve to detect inferior material of which the yield point alone may give no indication. The development and general use of such an apparatus would prove a long step toward putting an end to existing confusion.



CAMP EAST OF JOB ON NARROW CAUSEWAY STRETCHING 6 MILES ACROSS BEAR LAKE

Largest Bridge Caissons Rivaled by Timber Crib Sunk in Free Air in 34 Days

Narrow Space Available 3 Miles from Shore on Causeway Across Bear Lake, Idaho, Governs Layout of Construction and Concrete Spouting Plants

IN THE MIDDLE of a 300-ft. causeway of fine sand and clay which stretches for six miles across the northern end of Bear Lake in Idaho has been sunk, by open dredging, a timber caisson rivaling in size the large pneumatic caissons built for the Quebec, Manhattan and other bridges. Within this caisson is being constructed the main part of the Lifton pumping station of the Utah Power & Light Company, the design and object of which were described on page 68 of the Engineering Record of July 15, 1916. The work being twelve miles by indifferent roads from the two nearest railway points, it was necessary to get in all the plant and most of the materials during the winter while good snow roads were available. As the large retaining wall, the electrical equipment room, and the discharge flume are being constructed together with the station itself, a central plant for screening aggregate and mixing and spouting concrete was built. The open-dredging method and the heavy weighting necessary required a caisson with 16-in. walls and heavy interior bracing, trussed to support the weight pockets, in the construction of which were used 800,000 ft. b. m. of timber and 122 tons of bolts.

The elaborate formwork for the station itself could not well be built until the caisson bracing had been removed, and only the concrete skeleton of the main outside and cross walls is being built in successive lifts as the bracing is removed. When the bracing has been taken out in this way, the forms for the intakes, pump foundations, etc., can be built in clear open wells, allowing better work and more satisfactory location of the construction joints.

More Difficult Work Begun First

The contract naturally divided itself into the caisson, the cofferdam at its west end for the electrical equipment room, the deep retaining wall on the east end, the discharge flume and the concrete pile cutoff walls. The work has been started in this order, with the idea of having the preliminary work of excavation and pile driving finished in the same order, and at the right intervals to make concreting continuous.

It might be thought that some of the less difficult sections would have been started at first to provide a place to concrete at an early date. The work was begun, however, in the fall of 1915, and the caisson, the largest section, was constructed first both because concreting over the large area to be covered would have been expensive in the severe cold of winter and because sinking so large a caisson by open dredging was sure to cause settlement and likely to damage adjoining cofferdams or pile-driving work.

Camp and Timber Framing First Considerations

In view of these facts, the first work done while building the camp was to lay out a complete yard for framing the caisson timbers, start work on this feature and erect the four derricks to be used in building and sinking the caisson. The way in which this work was planned to secure the least possible handling of material on the narrow causeway is well illustrated in the accompanying drawings.

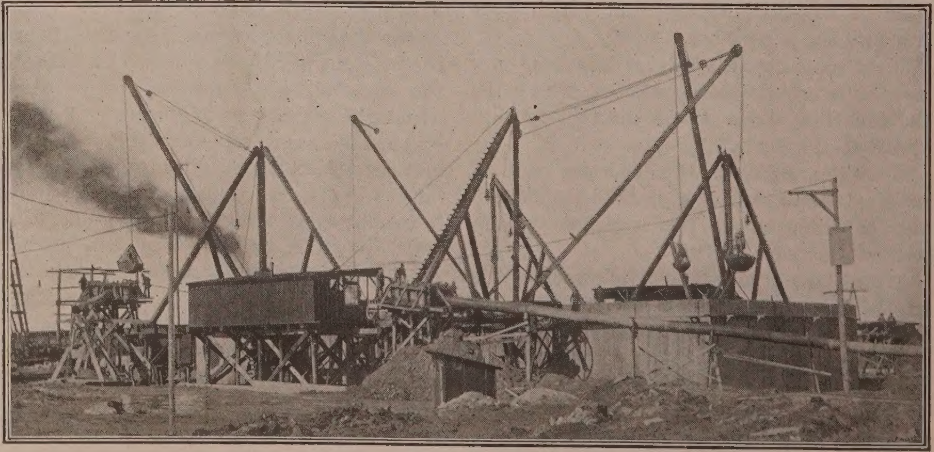
As the caisson was built up it was sunk by dredging with clamshell buckets, about 5000 of the 17,000 cu. yd. dredged being used for weight. The rest, and later that from the weight pockets, was dumped into hoppers and washed away in steel pipe flumes. The fine sand and clay were very hard to dig under water. Early in the sinking it was discovered that the amount of clay in the quicksand made it possible to pump out the caisson and loosen the packed bottom with picks until the dredge buckets could dig it economically. This was continued until the caisson reached final elevation. While the bottom remained firm at all times, the water following down the sides of the caisson brought in a great deal of sand under the cutting edge and caused the derrick staging to settle in spite of the fact that it was supported on piles driven 10 ft. below the final elevation of the cutting edge.

The caisson itself, 62 x 140.5 ft., sunk to a depth of 46 ft., compares in size with the 55 x 180-ft. caisson sunk for one of the Quebec bridge piers and the two 78 x 144-ft. caissons on which the Manhattan bridge rests. The big bridge caissons, however, have been handled with compressed air, and it is thought that the present one is probably the largest timber caisson successfully sunk without the help of the even support which the use of compressed air makes possible.

Bottom Rises with Pile Driving

The caisson reached final elevation April 6 last, forty-four days after sinking was begun. For ten days of this time excavation was suspended while the second build-up was made. In driving the 770 foundation piles with jets and followers to a penetration of 30 to 40 ft. below the footing, the sand bottom raised 2 ft. It was brought down to grade again by stirring up the packed sand and clay with the jets used to drive the piles and by pumping it out with centrifugal pumps. An 8-ft. seal of concrete was then placed by tremie in the open.

The concrete shell to support the walls of the caisson while the interior concrete work is being completed is being carried up in 5-ft. lifts, the concrete being poured directly against blocking set against the timber walls of the caisson between posts, after removing each successive layer of bracing. Concrete walls under the discharge flume, extending out to the double vertical posts of the caisson on that side, permit the removal of all bracing below the floor



BIG CAISSON SUNK BY FOUR DERRICKS—STEEL FLUMES CARRY AWAY SPOIL

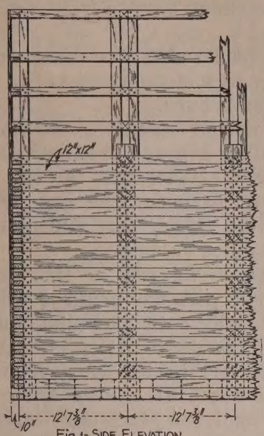


Fig.1-SIDE ELEVATION
Outside Sheeting not Shown

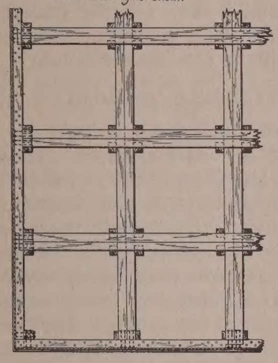


Fig.2-CORNER PLAN

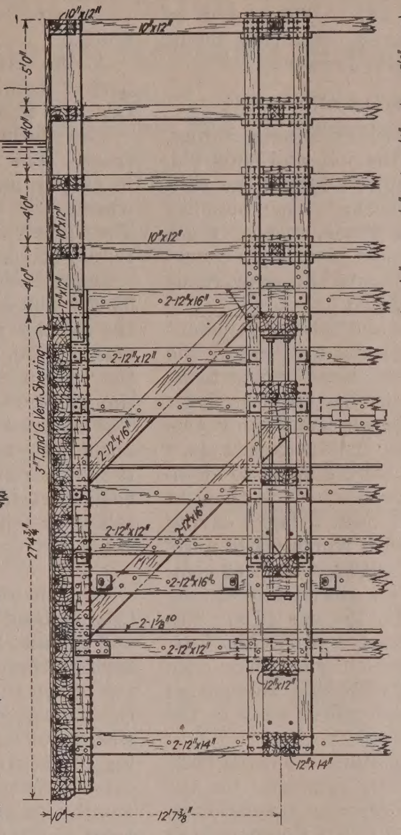


Fig.3-LONGITUDINAL SECTION ON CENTER LINE

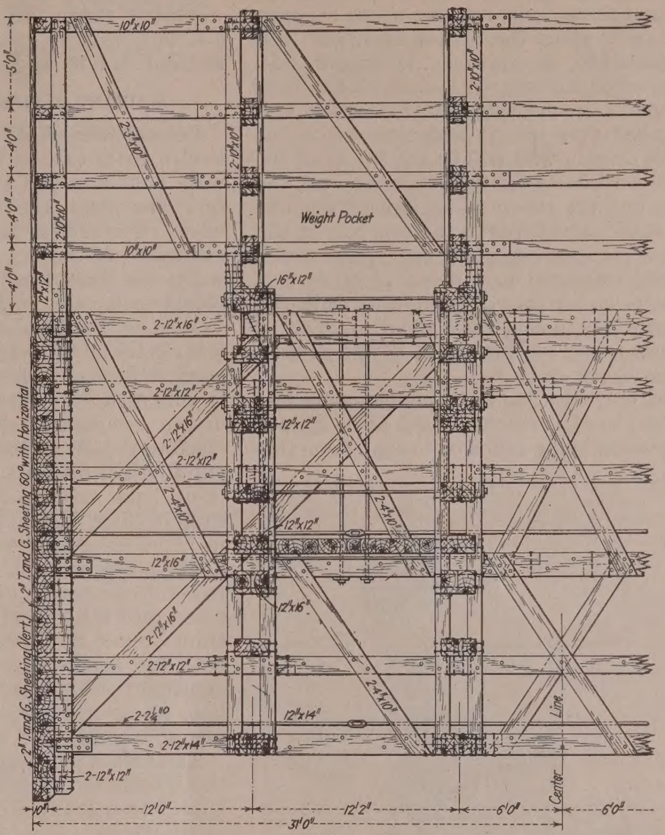


Fig.4-CROSS SECTION

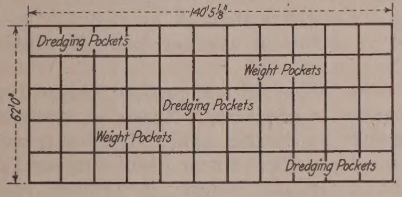


Fig.5-DIAGRAM OF CAISSON

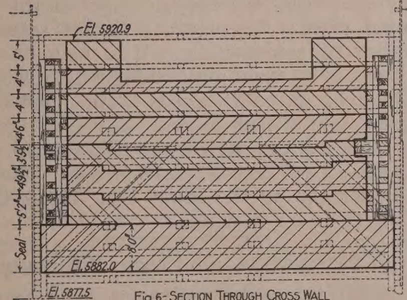


Fig.6-SECTION THROUGH CROSS WALL

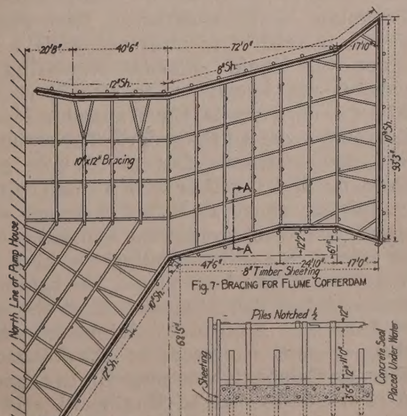


Fig.7-BRACING FOR FLUME COFFERDAM

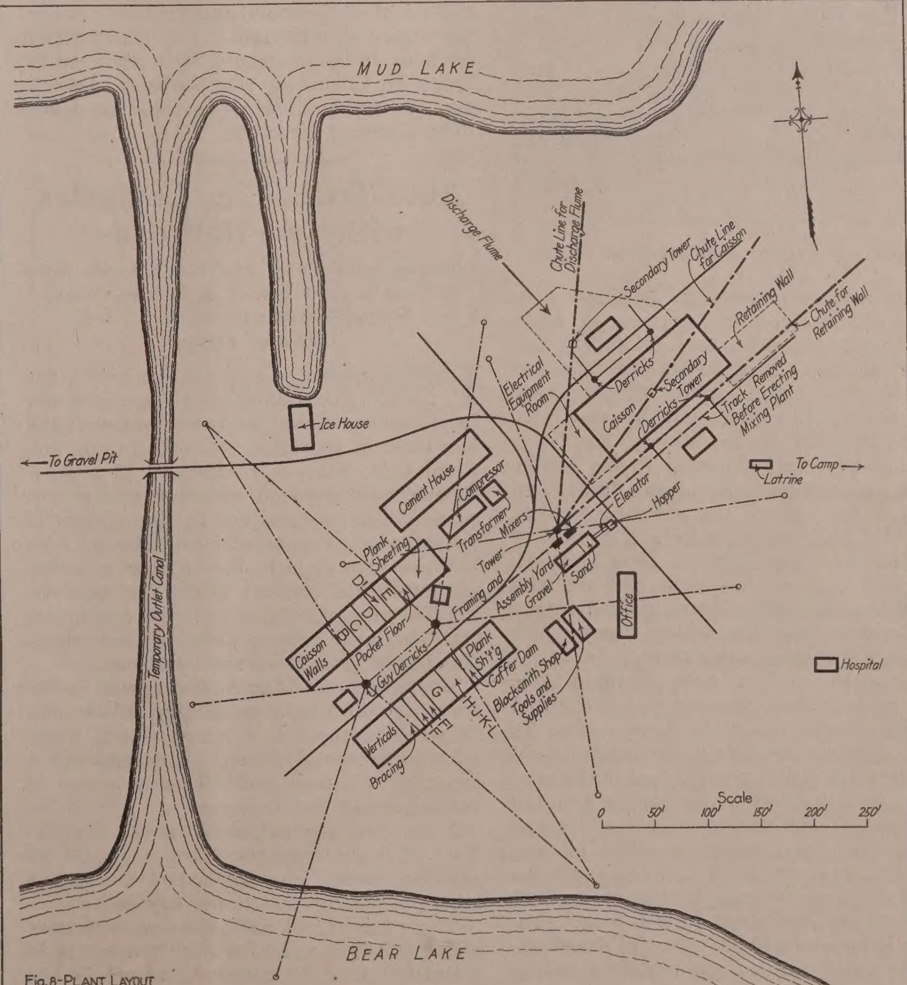


Fig.8-PLANT LAYOUT

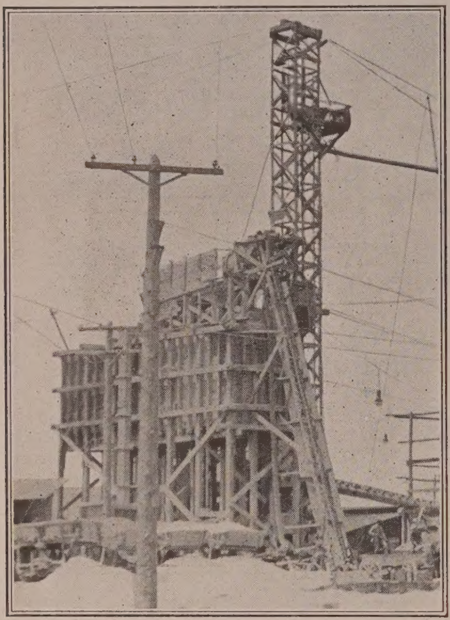
CONTRACT WAS LAID OUT TO DEVELOP WORK ON CAISSON, ELECTRICAL-EQUIPMENT ROOM, RETAINING WALL AND DISCHARGE FLUME IN ORDER

Figs. 1 to 4—Details of timber caisson construction. Fig. 5—Plan showing location of weight pockets. Fig. 6—Section through cross-wall of the concrete shell built as bracing was removed, showing transition blocking. Fig. 7—Plan of cofferdam for discharge flume. Fig. 8—Layout of construction plant. Sections of framing yard reserved for each caisson course. Concrete plant not erected till assembling of caisson was completed.

of the flume. The spaces under the flume between these walls and the space between the concrete and the caisson elsewhere will be backfilled, except on the intake side. Here, after the approach channel has been dredged, the whole side of the caisson will be pulled over into it and removed.

The caisson wall will be cut inside of the three cofferdams for the retaining wall, the flume and the electrical-equipment room to join those structures to the concrete of the station proper. A steel cofferdam which will be excavated to a depth of 40 ft. has been driven for the retaining wall, while the electrical-equipment room requires 24 ft. of excavation across the width of the caisson at the other end.

The only bracing in the flume cofferdam will be placed above water, the 12-in. splined fir sheeting being relied on to span from this bracing to the concrete seal. Because of the size of this cofferdam, a number of extra long foundation piles will be driven and cut off at water level to support intersections of the bracing. After the piles have been driven the seal will be concreted against the wall of the caisson. The latter will then be removed almost to the bottom of the seal and the floor of the flume completed to the side of the pumping station.



SCREENING, MIXING AND SPOUTING PLANT

After a long search, a narrow deposit of suitable sand and gravel, 150 x 1000 ft. and 4 or 5 ft. thick, was found near the west end of the causeway. It is worked with a skid-derrick dragline, which dumps into 4-yd. cars that are hauled three miles to the job by a 15-ton 3-ft. gage steam dinkey. These cars feed an elevator delivering to a rotary screen on top of the storage bins. To save building these bins to the extra height necessary for direct gravity feed to the mixers, a traveling measuring hopper running the length of the bins on a track above and behind the mixers, was used. Two mixers, one 1-yd. and one 1¾-yd., were available, and both were set up to insure against delays. They discharge into a tower skip which is hoisted 110 ft., from which elevation the concrete is spouted to a distributing tower. This tower is now set on the center of the caisson, from which position the secondary chutes can cover the main station and the electrical-equipment room at one end. It will be moved once to concrete the retaining wall and again to concrete the discharge flume. In all, 15,000 cu. yd. of concrete will be poured, requiring about 200,000 ft. b.m. of form lumber.

Hauling Materials and Plant

Cement was received at Dingle Siding, twelve miles east of the job, and 6000 bbl. were hauled in and stored during the winter. The plant, timber and other supplies were all received at Paris, twelve miles northwest of the job, and practically everything was hauled in before the snow roads became soft early in April.

Most of the hoists and other equipment are electrically driven, and the rest of the plant, together with the wood-boring tools, is run with air supplied by an electrically driven compressor station containing two machines, each of 1000 cu. ft. capacity per minute. The air lines were difficult to maintain in the extreme cold, and it is thought that if there had not been a large saving in using equipment with which other units of the power system had been built as compared to bringing new electrically driven plant into the country, the use of air machines would not have been profitable. Current for the construction plant has been supplied through a 44,000-volt transmission line, which will furnish power later to the pumping plant.

The Lifton pumping station is being built by the Jarrett-Chambers Company for the Utah Power & Light Company, a subsidiary of the Electric Bond & Share Company, the engineering forces of which have had charge of the design and construction of the entire development. The construction methods and plant layout were designed by Ralph H. Chambers and Edwin S. Jarrett, and the work is being carried out under their personal direction.

Auto-Truck Line Competes with Two Railroads

Charges Same Rates and Hauls Loads Much Beyond Rated Capacity of Trucks—Heavy Wagon Fitted with Rubber Tires Used as Trailer

For somewhat over a year an auto-truck freight line, taking advantage of a new brick-paved roadway between the two cities, has been in operation between Tampa and Plant City, Fla.—a distance of 22 miles—in direct competition with two steam railroads. The rate charged for the freight is the same as that charged by the steam lines; but the advantage to the shipper in using the motor line consists in the fact that deliveries are made direct to the consignee, thus eliminating the expense of transportation to and from the freight stations.

There are two 2-ton Selden trucks in the service, both a little more than a year old. In addition there is a heavy wagon fitted with rubber-tired wheels. This also has a capacity of 2 tons and is used as a trailer behind one of the machines.

Four men are employed in the service. Two of these, the chauffeurs, are paid $3 per day each. The other two are negro laborers, who receive $1 per day each.

The cost of oil and gasoline averages about $12.50 a week for each truck. It is estimated that 10 miles of travel is obtained from a gallon of gasoline.

All minor repairs are made by the chauffeurs. The owners of the line operate a sawmill at Plant City and do a great deal of work in their own machine shop. Other repairs are made in garages. The total cost of repairs is about $300 a year for each truck.

At the Tampa terminal the company uses part of a store as a station and at the Plant City end it has a barn.

The yearly license expense is $50 for each truck. The tires average about 8000 miles in service and cost $25 each for the front wheels and $52 each for the rear wheels. The tires on the trailer cost $22 each and render 20,000 miles of service.

Depreciation is figured at the rate of 33 1/3 per cent, with the original value of the trucks $2,200 each and that of the trailer $250. The depreciation is heavy, as the trucks are overloaded very often and the drivers are not of a very high type. The average load for truck and trailer is about 2½ tons, though 3½-ton loads for the trucks and 3 tons for the trailer have been carried. The average speed maintained on trips is 8 miles per hour.

Condition of Road

The entire road from Tampa to Plant City is built of vitrified brick. It is new and smooth, but for a heavy truck with stiff springs there is considerable vibration owing to the slight difference in the height of the bricks. The weather is never cold enough to interfere with operations. During the greater portion of the year there is very little rain, but during the summer months there is usually a shower lasting from one to two hours each afternoon. Records from the local weather bureau for the past five years show an average of 111 days of rain for an average annual rainfall of 49½ in.

The principal commodity shipped from Tampa is groceries. There is also considerable hardware, grain, feed and miscellaneous traffic. From Plant City to Tampa the principal freight is lumber, canned goods, crate material and vegetables.

As stated previously, the rates charged by the truck line are the same as the railroad rates. There are different rates for different commodities. The rate on groceries is 32 cents per 100 lb., which is about the average on all goods. The business is on a strictly cash basis.

The trucks leave Plant City early each morning and return the same day. The line is operated by the Plant City Truck Company.

Chlorination at Camp Whitman

When it was decided to supply the mobilization camp for New York State troops at Beekman, N. Y., with water from Fishkill Creek, instead of from driven wells, a rush order for liquid chlorine sterilizing apparatus was telephoned to New York City. At 10 a. m., June 24, the Wallace & Tiernan Company received the order. The apparatus left the company's factory at 4.30 p. m. the same day, together with a small cylinder containing about 10 lb. of chlorine, which was taken along so that the apparatus could be placed in service pending the arrival of a larger supply of chlorine. The equipment was installed and in operation on the night of June 24. Alan M. E. Johnstone, one of the assistant engineers of the Wallace & Tiernan Company, was sergeant in Company A of the 22d Corps of Engineers. He was detailed by Colonel Lucas to supervise the sterilization of the water supply. Sergeant Johnstone made a trip to his company's factory on short notice and took the apparatus back with him.

Separate Sludge Digestion Improves Imhoff-Tank Operation by Keeping Sewage Fresh

Auxiliary Sludge Chamber Provided—Two Pumps Simultaneously Force Fresh and Decomposed Sludge Into One Pipe to Secure Mixing

By DR. KARL IMHOFF
Division Engineer, Emscher Federation, Essen, Germany

Translated by Leslie C. Frank, Sanitary Engineer, U. S. Public Health Service

THE MOST MODERN and the most widely used methods of sewage treatment show an unmistakable tendency to keep the sewage as fresh as possible, to remove the settled sludge from the settling chamber as rapidly as possible, and to cause this sludge subsequently to undergo a process of anaërobic decomposition in a separate chamber. Imhoff tanks are included in this category. The characteristic of an Imhoff tank is that it is composed of a sludge chamber situated under a settling chamber and so connected with the settling chamber by means of a slot as to permit the settling sludge to slide by gravity from the latter into the former, but so as to prevent any flow of sewage through the sludge chamber.

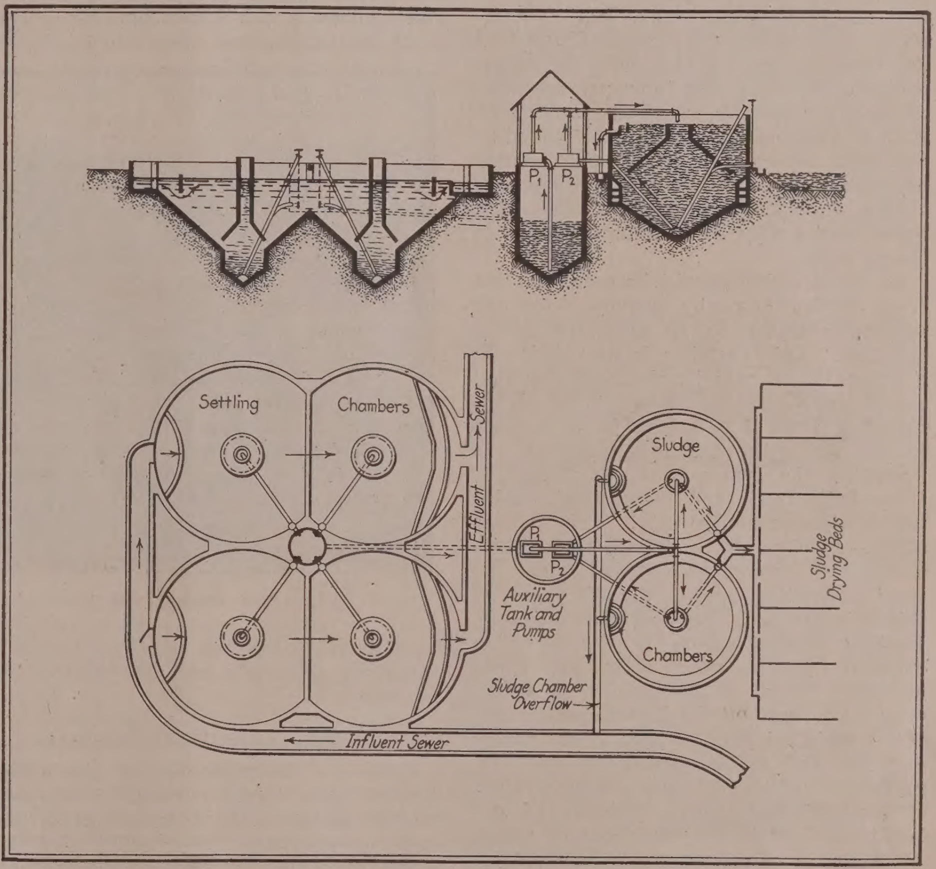
Objection has sometimes been made to Imhoff tanks on the ground that they necessitate two-storied construction, with its attendant difficulties and expense; and attempts have frequently been made to secure the advantages of Imhoff tanks by placing a sedimentation chamber and a sludge-digestion chamber side by side and then pumping the sludge from the former to the latter as a substitute for the gravity flow in Imhoff tanks. However, many difficulties have developed in the course of these attempts and it is only recently that these difficulties have been obviated.

SEPARATE SLUDGE DIGESTION

In the following discussion, apparatus will be described in which the settling chamber and the sludge-digestion chamber are situated side by side and in which it has been found possible both to keep the sewage fresh and to digest the sludge satisfactorily. All apparatus herein described has been constructed and operated on a practical basis in large municipal sewage plants.

The difficulties which have developed in connection with separate sludge digestion are twofold. They relate to the settling chamber and also to the sludge chamber. The problem in connection with the settling chamber is to remove the sludge from it so frequently and so completely as to insure the maintenance of the sewage in a fresh condition. The older type of plant, in which it is necessary to pump out the total water content of the tank each time sludge is removed, will not be discussed here, as this type of plant is not practical. There is only one other form of plant, and in this form the sludge is removed from the tank without discharging the supernatant liquid. The invert of the sedimentation chamber in designs of this kind must be divided into one or more sumps and a sludge-discharge pipe inserted for each sump so that its lower end reaches to the lowest end of the sump. In the operation of plants of this kind it has developed that the sludge cannot all be removed, but that a considerable portion always remains sticking to the walls. In addition, the inevitable funneling of the sludge in the sump and the consequent discharge of water with the sludge unnecessarily increase the water content of the latter. The residue of sludge which remains in the sedimentation chamber decomposes, gasifies, floats to the surface and may thus escape with the effluent.

In the accompanying drawing these difficulties have been avoided by the addition of a hood above each sludge sump. The presence of this hood makes it unnecessary to remove all of the sludge at each operation. Even if the remaining sludge should become septic and float it would be confined to the hood and not endanger the effluent. In effect, it would rise to the surface inside the hood, sooner or later give up its gases and finally sink again to be removed with the next sludge discharge. Inasmuch as the sludge is never completely removed, it is impossible for water to break through and escape with the discharging sludge.



FRESH SLUDGE FLOWS BY GRAVITY FROM SETTLING CHAMBERS TO AUXILIARY SLUDGE CHAMBER PROVIDED WITH PUMPS, WHICH DISCHARGE SIMULTANEOUSLY INTO A SINGLE PIPE TO SECURE THOROUGH MIXTURE

In addition to this device, which makes it possible to obtain sludge of relatively low moisture content and simultaneously to keep the sewage fresh, there are also a number of other new features included in the drawing. The tank is cylindrical and its invert is conical. Such a design permits the same slope at all points of the invert and causes the sludge to slide uniformly toward the lowest point. Statically, also, this form of tank is the best. It makes possible the use of thinner reinforced-concrete walls than any other design, since it is exactly adapted to receive the stresses produced by the upward pressure of ground water and by the radial pressure of the liquid contents.

FLOW HORIZONTAL

The direction of sewage flow in the tank is horizontal and not downward and upward, as has hitherto been usual with circular tanks. The downward and upward direction of flow has been found to be inferior from the standpoint of percentage removal of settleable solids. Nor does the sewage flow from center to circumference as in the past. It flows from one side of the tank to the other, so as to produce a longer flow line and at the same time to eliminate a considerable portion of the excessively long circumferential effluent channel. This form of tank therefore approaches most nearly an ideal design from the three standpoints of statics, sewage sedimentation and sludge removal. The drawing shows two tanks combined as one.

The decomposition of sewage sludge in separate chambers was first believed possible in shallow flat-bottomed tanks. It was thought that it would simply be necessary to pump the sludge into these tanks and allow it to remain until sufficiently decomposed. All attempts of this kind have, so far as I am aware, failed. The sludge in these tanks produces unpleasant odors and takes a long time to decompose to anything like a condition in which it can be dried without nuisance.

A properly designed sludge-digestion

plant should be one in which the sludge takes only a few months to decompose to a condition in which it dries easily and without producing a nuisance. Neither should any foul odors be produced in such a plant during the process of decomposition. These requirements have been satisfied in Imhoff tanks, and it seems logical, therefore, to imitate artificially in the separate digestion process the conditions obtaining in an Imhoff tank. The design shown in the drawing is the result of a successful attempt to imitate these conditions.

Promote Growth of Organisms

In order to achieve odorless decomposition it is necessary to promote the growth of the proper organisms and to maintain the conditions necessary for their existence. With this in mind it seems logical to *feed* the sludge that is properly decomposing and to *inoculate* the fresh sludge with the proper organisms as soon as it arrives. This inoculation is necessary so that the fresh sludge may not have an opportunity of entering into improper decomposition—for example, acid decomposition. Both of these conditions may be fulfilled by the same device. In short, it is merely necessary to *mix* the fresh and decomposed sludge in accordance with certain rules. Such mixing may be most simply done in closed pipes.

In the drawing it will be seen that the fresh sludge flows by gravity from the settling chamber to an auxiliary sludge chamber. This chamber is provided with a pump P_1. It will be observed also that a pipe leads from the bottom of the sludge digestion tank to a second pump P_2, also located above the auxiliary chamber. In operation the two pumps simultaneously force both fresh and decomposed sludge into a common sludge pipe. This manner of operation results in immediate mixture of fresh and decomposed sludge in any desired proportion and in the discharge of this mixture into the digestion chamber. Further mixing occurs in the digestion chamber itself by means of the rising gas bubbles. The small gas bubbles which develop as a result of the decomposition process remain sticking in part to the sludge particles and by increasing in size progressively reduce the mass specific gravity of the combined sludge particle and gas bubble until it is less than that of water. At this time, of course, the two rise to the surface of the tank.

If the action taking place on the inside of the digestion chamber could be observed it would be seen that large and small particles of sludge are continuously rising to the surface of the tank, there giving up their gas bubbles, and, once more heavier than water, sinking back to the sludge layer at the bottom of the tank. This natural mixing, however, is insufficient. If it alone be depended upon it will be found that in a short time a scum layer will develop and will grow thicker and thicker. When, after this begins to take place, gas-laden sludge particles rise as described they are not able to release themselves from their gas bubbles because of this impenetrable mat on the surface, but instead become imprisoned in it. Little motion or mixing takes place in this scum layer, and for this reason it will be found that the decomposition taking place in the scum layer will be relatively feeble, may indeed be an undesirable or nuisance-producing kind of decomposition. This evil may be artificially avoided by constructing in the digestion chamber a partition or apron which operates in a similar manner to the partition walls in Imhoff tanks. With this apron in place the gas bubbles are deflected to a definite point or points in the tank surface. In the drawing this point is shown as the middle of the tank. In consequence of this provision there will be no rising gas bubbles at any other part of the tank surface, and any floating sludge there, not being continually buoyed up afresh by rising gas bubbles, will gradually become heavier than water and sink to the bottom. In the middle of the tank, however, to which point all of the gas bubbles are being deflected, the combined stirring action of the gas bubbles is so strong as continuously to break up the scum layer.

It seems logical, also, to make this part of the tank surface the part at which the fresh sludge is introduced, because at this point exists the best opportunity for the fresh sludge to become mixed most quickly and most uniformly with the contents of the tank.

Uniform Temperature Desirable

Since the decomposition of the sludge depends upon living organisms it is necessary to maintain the temperature as uniform as possible. In Imhoff tanks this occurs naturally by virtue of the depth of the tank and because of the fact that the sewage which flows through the settling chamber above the sludge chamber is fairly uniformly warm. Separate sludge digestion chambers built above ground may develop difficulties because it may not be possible without artificial aid to prevent harmful fluctuations of temperature. Artificial means may therefore in this case be of advantage. In the drawing are shown circumferential conduits on the inside of the tank. These may be operated either with warm water supplied from a central heating plant or simply with sewage.

Lumber Cut of Central States in 1915

The U. S. Forest Service announces that 37 billion thousand board feet of lumber was cut in the Central States in 1915, a decrease of 300 million thousand feet over the previous year. There are 29,941 mills and the final estimate is made from reports received from 16,248.

Surveying 1000 Square Miles with the Camera

Phototopographical Survey Covers 93 Square Miles Per Month at Less Than the Cost of Plane-Table Work

GOVERNMENT officials wanted a map of the Columbia National Forest in Washington, which contains about 1,000,000 acres. The area is very rough and heavily timbered, so that the cost of a complete survey would have been considerable, even if funds for special surveys had been available, which were not. The matter was referred to the engineers of the Forest Service, and has been worked out in such a way that the surveys were made and accurate maps showing 100-ft. contours and all streams were produced ready for the engraver at a total cost of $4.60 per square mile.

The work, which is to be finished this year, has been handled almost entirely by one man, who spends the open seasons in field work and the winters in working up the notes. With a single man as assistant and packer, two saddle horses and two pack animals, he covered an average of 93 square miles per month. When the weather was good he "occupied stations," making observations and photographs; and when there was smoke or rain the party moved camp, made new trails or traversed roughly the level areas where phototopographic methods were least effective. Work progressing in this manner for several years has produced each season accurate maps of those sections of the forest where data about the topography were desired immediately; and in the course of continued experience, particularly convenient methods have been developed and applied.

THIS PHOTOGRAPH EQUALS A BOOK FULL OF TOPOGRAPHIC NOTES

Field Work

The camera used is a Coast and Geodetic Survey outfit No. 8, using Seed nonhalation L ortho 5 x 8-in. plates. Plates are developed in the field, a tank and changing bag being utilized. The usual practice is to make four exposures at each station, each embracing the view within a 65-deg. angle. The selection of stations is the phase of the field work which requires the most care, both as to number of reference points visible and the view of adjacent slopes which the station commands. It has been noted that the most useful views are taken when the shadows are such as to bring out the contour of the hills. The accompanying photograph illustrates the qualities which the topographer endeavored to secure when possible. Practically all the photographs are taken through a ray screen with U. S. aperture 64.

Averages for the seasons in which the field work has been carried on show that stations were occupied on 30 to 40 per cent of field days, that 32 per cent of field days were spent in moving camp and that photography was not feasible on account of smoke, fog or rain on 32 per cent of the field days. About fifteen stations are occupied each month, and the usual contour of the territory covered is such as to require about sixteen stations per 100 square miles.

The cost of the field work, exclusive of the primary triangulation which had already been done by the Coast and Geodetic Survey, was made up of the salaries of topographer and packer, provisions and photographic supplies, the use of four horses and their maintenance. Averaging the total of these items for two years gave a rate of $2.75 per square mile for the field work. The last season there were an additional man in the party some of the time and two extra horses, which increased the cost accordingly.

OFFICE WORK

In the office the topographer works up approximately 50 square miles of the map each month. The scale is 1 in. to the mile and the contour interval is 100 ft. The map is laid out first, showing the primary points located by the Coast and Geodetic Survey, and from these points the locations and stations selected by the topographer are put in, using the photographs and a method of intersection or resection as conditions permit. There are nine primary survey points in the forest and about fifteen main locations which the topographer uses as reference in orienting the remaining 200 locations.

All these points are located on the map by plotting the observed angles with an accurate protractor. When more than two photographs show a point which it is desired to locate on the map, each additional view in which it appears constitutes an additional check on its position as already plotted. Where there is any question about position, as many views as possible are consulted and used to check.

Each photograph bears on its margin the mark of a horizon line below and above which depressions and elevations are measured respectively. Three points are used to determine elevations through which contours are drawn, and it has been found that the results thus obtained are correct to within 50 ft. of actual elevations. This is considered close enough for the work in hand, particularly in country where the timber is high.

The cost of the office work, which included only the topographer's salary and supplies, averaged $1.85 per square mile for two years, so that the total cost for field and office amounted to $4.60 per mile in these seasons. Since that time some sections of the work where particularly accurate results were desired were done with greater care, using five locations per mile, and this work cost about $7.65 per square mile.

In 1911 the same topographer was employed in making a plane-table survey of a similar area. The cost of this survey, with map ready for the engraver, was $6.15 per square mile. In comparing these two cost figures it should be borne in mind that the plane-table is slower. In work with that instrument only 53 square miles per month were covered, as compared to 93 square miles with the other method.

The work in the Columbia National Forest has been done under the direction of George H. Cecil, district forester. Lage Wernstedt, forest examiner, carried on the field and office work.

Water Measured by Volume in Large Turbine Test

Used as Check on Current-Meter Determinations at Turners Falls Electric Plant — Measurements Made Through Ice

TO CHECK the quantity of water used during tests of the 7500-kva. units at the plant of the Turners Falls Power & Electric Company volume measurements, as well as current-meter determinations, were made. The former were secured by observing the extent to which the pond was drawn down and making a careful survey of the pond area. The methods were described recently in a hearing before the Massachusetts Gas and Electric Light Commission.

The power output of the wheels, which are of the I. P. Morris vertical type, was measured electrically and corrections were then made for generator efficiency. The head was measured by gages in the wheel case and in the river. To obtain the quantity of water, the current meter was used in the canal just in front of the wheel to be tested. In order to separate the test unit from the other units, a flume about 40 ft. long was built in front of the openings to the head gates. Two current meters were used in this flume.

The test was somewhat complicated by being made in winter, and it was for this reason that bulk measurement was used, ice on current meters sometimes being troublesome. The pond measurements required more time and were not so frequently made, but the two methods checked within 1 sec.-ft. out of 1600 sec.-ft. The amount the pond was drawn down was measured on twenty-two gages up and down the length of the canal, as the variation in different places needed to be considered. At various times twenty-eight men were reading gages. A test run required two hours. The ice on the pond made it easier to get an accurate measurement of the drawing down of the water, no wind effects being present. Every gage was in a small hole cut in the ice and the water was perfectly still. There was some leakage out of the canal, which was measured by closing the cofferdam gates at night and measuring the reduction in canal level.

Dusting Prevents Coal Mine Explosion

The Federal Bureau of Mines has concluded, as a result of a large number of experiments, that the dusting of finely pulverized rock in coal mines prevents, or at least checks, explosions. Experiments have been made not only in the government's experimental mine near Pittsburgh, but also in actual workings. The work has progressed so far that the effective proportion of shale dust to coal dust has been determined for coal dust from many seams. A special gasoline-driven car with a blower has been designed for distributing the dust.

Stream Flow, Not Rainfall, Best Criterion for Yield

Clemens Herschel Urges Engineers to Use River Measurements as Most Reliable Basis for Water-Power Predictions

WHY, when seeking runoff, should engineers turn their backs upon it, and go off poring over records of rainfall, and endeavor, by dint of much tribulation, to compute a relation between it and rainfall? This is the question asked by Clemens Herschel, consulting engineer, of New York City, in a recent discussion, before the Boston Society of Civil Engineers, of power estimates from stream flow and rainfall data. That sort of thing, he said, was well enough in the '40s of the nineteenth century, when it was started, but to-day it must be recognized as a false method of work, and engineers' energies should be concentrated on stream measurements and a comparison of such, when the future yield of drainage areas is in question. It is submitted that by such comparisons or analogies much more reliable results in the line of yield prognostications can to-day be obtained, when direct gagings are lacking, than rainfall studies, and computations based upon them, can ever furnish. The main points in Mr. Herschel's argument follow:

RUNOFF DIAGRAMS

Having given a record of runoff gagings, how shall they be arranged for the use of the hydraulic engineer?

Now, confining ourselves to the considerations uppermost in the mind of the engineer of water *power*—not water *supply*—it has long been clear that there must be one best way; also that in the interests of efficient work and of an avoidance of wasted effort this best way should be followed, rather than pursue the study of many such ways.

A mine of information on stream flows is contained in the reports of the U. S. Geological Survey on that subject, which now number 400 volumes. It is no exaggeration to say that for water-power purposes, giving all data needed for that purpose, these 400 bulky reports could be condensed into 400 single-page cuts contained in one volume, and at an enormous saving to the work, time and expenses of the hydraulic engineer.

For the purpose of facilitating comparison and reducing all the records to the same specific scale, as it were, the collected diagrams should be plotted to represent second-feet per square mile, instead of second-feet. Underlying details would not be lost, but if ever needed (a matter of some doubt) could be supplied by the Survey Office. In answer to an inquiry requesting suggestions, Mr. Herschel made the above recommendations to the Geological Survey office and reiterates it as his matured opinion on the subject.

If the daily discharges of a river at a certain point be plotted for the 365 days of the year, *in the order of their magnitude* (not consecutively in the order of the date of their occurrence), a perfectly smooth curve showing the year's discharge will be produced. Take fifteen or twenty such years, if the records avail, and three such curves may be produced—one of average flow, another enveloping all the minima flows, and a third enveloping the maxima flows. And for a period of that length the discharge of that river, at that point, has been portrayed practically for all time. Nothing, or little more, is needed in its hydrographic study, for the uses of a constructing engineer. Its original data may have interest for a meteorologist, when he philosophizes as to the relation between such three curves and rainfall data, but an engineer has nothing to do with that. The rainfall may be anything; it will not change the recorded runoff, nor the ranges of runoff shown by these three curves. And it is these data that are needed for useful purposes—the province of the engineer—in contradistinction to the pastures of recreation that incite the philosopher or scientist. The same data may also be presented, if preferred, in tabular form—would have to be so, before they can be "boiled down" into the diagram which has been described.

TABLES AND DIAGRAMS

As an example of the tables and diagrams spoken of, one of each is reproduced in Mr. Herschel's printed discussion in the June *Journal* of the Boston Society of Civil Engineers. Bold-face figures in the table, showing maximum and minimum in each horizontal line, give the data for the enveloping curves that have been spoken of. Two full lines extending across the table mark the limits between which the economical capacity for turbines to be installed will ordinarily be found. The data for the curve of average flow (averages of each horizontal line) can be readily found from the table.

The diagram referred to is the concise and true representation of the regimen of the river, giving all data needed by a hydraulic power engineer. If we had such diagrams for the principal points on every river of importance in the United States, Mr. Herschel contends, it would be the fulfillment of hydrographic study of river flow within the United States. A single volume containing such diagrams would then take the place of the several hundred volumes of undigested material relating to river flow which now obstruct useful work and the exercise of judgment, not to mention the lucubrations of rainfall recorders and of their obsequious followers.

In taking up this subject, let us assume that we speak here only of the ultimate development at any given mill site. Power machinery may be installed at time intervals, as power is called for. Even the power house may be built in sections. Let us also recognize that while power dams and power houses are built to last forever, and as a matter of fact naturally do endure on the average longer than most any other work an engineer is called upon to design and construct, yet the duration of such things as "load-factors" and given "peak loads" are in comparison but fading fancies. How, then, can they properly enter into a computation for powerhouse design in conjunction with factors that are eternal, or nearly so? The tendency of powerhouse management is constantly to strive for a load factor of one, and both the progress of invention and of sociology is working to that end. By the time a network of interconnected power wires, each arranged to convey a constant daily quantity of power, will have spread over all the thickly settled portions, or over the whole of the United States, farms included, which is rapidly being accomplished, where will the load factor and peak load be then?

The state of electrical development just described is rapidly being accomplished in the Province of Ontario, Canada, as a state enterprise, and there is nothing but notions of sociology to hinder its coming true in the United States by private enterprise. Another consideration which this thought brings up is the one of variable power from day to day at any mill site; very present to those who are operating or have operated water power on most any stream except on those constituting the outflow of the Great Lakes; and the subject of permanent and surplus power, or, to use the later terms, of "primary" and "secondary" power.

Suppose we assume that there is no secondary power (there need not be); that it is all power that can be relied on to be at hand when called for. So far as Mr. Herschel's judgment goes, based on ten years' experience in the administration of a water power, that is the only kind of power that should be offered for sale in the existing and the to-be-expected development of the business; in the interests of the seller, no less than in that of the buyer; and with the legitimate aid of heat engines and fall increasers to tide over low water and "backwater" troubles, and in spite of unavoidable annually recurring diminutions of power output, during nearly all the days of the year, there is no difficulty in attaining a uniformity of power output throughout every day of the year.

One might go further and prove that only by amalgamating heat engine and hydraulic power in this way can a full or complete return be gained from hydraulic power plant investments. All this was well understood full fifty years ago in New England manufacturing circles, if not elsewhere; but, with the advent of the electrical transmission of power, an army of ardent electricians, ill informed on hydraulic matters, were let loose upon an expectant country, and they had to learn all this over again. Some of them and their backers have not learned it yet. We still hear of the minimum flow of the river on any one day in twenty years, as furnishing the measure of "primary" power, and there are great hydraulic power plants that needlessly waste over their dams, on more than half the days of an average year, a quantity of water which if properly utilized would generate 100,000,000 or 150,000,000 kilowatt-hours annually, at a cost less than the fuel cost of the heat engines that must be installed to tide over *low-water* diminutions of normal power output.

Then there is the consideration of how much reservoir capacity or pondage is to be added to the power plant for the purpose of making the water supply more uniform, tending toward that happy era when there shall be no more times of low water and no more freshets.

A GERMAN OPINION

A German writer has recently stated such a proposition as follows: "Procedure for the determination of the most economical part of the annual run-off to be used; size of reservoir; and amount of auxiliary heat power which should be selected in the construction of water-power plants."

As the learned author treats the subject, this includes a choice and determination: (*a*) Whether to use no water at all, or all the water that comes down the brook or river during the year; or what portion of the annual discharge of the stream is to be utilized; (*b*) whether to have no reservoirs, or reservoirs large enough to utilize the whole annual river flow; or what intermediary reservoir capacity is to be constructed; (*c*) whether to have water power only or to use auxiliary heat engines; and, if any are to be used, to what extent; certainly a comprehensive program. And all this is to be answered strictly by computation, and results given by formulas expressed in mathematical symbols! Does not this suggest the line: "Out of too much learning become mad?"

But let us analyze the task entered upon; (*a*) and (*b*) may be considered together, (*a*) being a function of (*b*). And economic reservoir capacity, to ordinary minds, is plainly a local consideration, to be answered in each case by the local situation, let the formulas say what they will.

It is only very gradually that the mere idea of the applicability of the powers of eminent domain to the taking of land by condemnation for water-power purposes is being recognized in state constitutions and in court decisions, thence spreading to legislation (see a decision of the United States Supreme Court of Jan. 24, 1916, in the case of the Alabama Interstate Power Co., opinion by Justice Holmes, as an important step forward in this direction); and without such right the opportunity of making use of computations relating to reservoir volumes would be somewhat doubtful. Then, again, are we to ignore topographical facilities or difficulties in such cases, in favor of the demands of general formulas?

TRIAL ESTIMATES VALUABLE

The writer believes that trial estimates will furnish a better guide in the vast majority of cases, very likely in all of them; and general experience has also indicated, at least as a beginning, to be modified if need be, by trial estimates in each case, how to answer division (*c*) of the problem as stated above.

This answer has already been indicated in the table of river flow above referred to, and may be stated as follows: The most economical discharge capacity of the turbines to be installed, so as fully to utilize the run-off at any mill site, is never very far either side on the diagram of the average river discharge on a day, than which there are as many days in the year of a greater as there are of a lesser river flow.

If, now, we have further the fall at the considered mill site appurtenant to the several river flows, fall also may be plotted as a curve; and from the two, quantity and fall, "Macaulay's schoolboy" could compute and plot the curve of resultant power for every day of an average year.

One factor more should, however, be taken into account. To accommodate peak loads or power variations occurring during the day, it is well to install wheels of a greater power capacity than has so far been indicated, running them normally at part gate. With all this entering into the computations, there will result the diagram given above, which presumably will need no explanation.

Auxiliary heat engine power, although its measure is indicated on the diagram, is not needed as a rule at first, except in process of developing the sale of power from the works, up to their full output capacity; and may thus be added gradually, as, indeed, may frequently, hydraulic turbine and even powerhouse capacity. All this makes for convenient elasticity in first installation, but will result, finally, in what we have all along been aiming to attain, primarily or eventually, a full economical utilization of the natural resources of that power site.

How the Government Handles Its Roadway Parties in the Valuation Work

Elaborate Note Forms and Type Sheets Simplify the Inventorying on the Eastern District, and Guide the Special Parties

By C. W. STARK
Associate Editor, Engineering Record

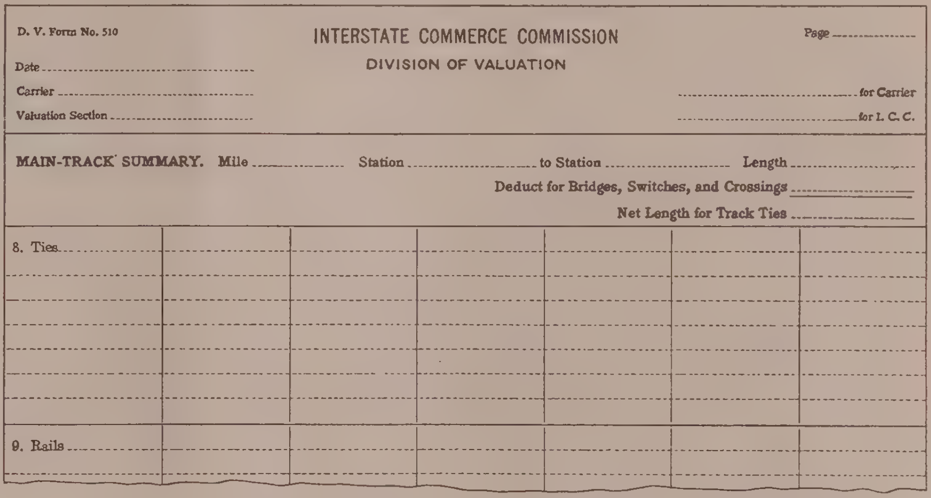
NOT ALL of the problems connected with the federal valuation of the railroads have to do with the fundamental principles of valuation, nor yet with the general questions of orders and administration. The very inventorying of the physical plant, with its infinite number and variety of structures and types, in notes that can be interpreted in the office, and will leave no gaps, is a task in itself, as stated in the article in the issue of July 8, page 43. The district heads have attempted to simplify this part of the work as far as possible by the assignment of the work to the roadway and special branch parties and their squads, and by their note forms. As the roadway parties are the only large parties, and as their records form the backbone of the entire inventory, much depends upon how they handle their work. In the Eastern District an elaborate set of note forms and type data have been adopted. The observations that follow are based upon a visit by the writer to a roadway party working in southern New Jersey. The general method of procedure and use of forms is the same, however, throughout the district.

WORK IS DIVIDED INTO FOUR PARTS

The assignment of work for the roadway party on the Eastern District is substantially the same as on the Western District, described in the Engineering Record of Dec. 26, 1914, page 696. About nine men, including the assistant field engineer in charge, constitute the roadway party. One part of their work embraces chaining the road, noting the pluses of all bridges, culverts, buildings, crossings, switches, signs, rail changes and other items of fixed plant, and either taking such notes as will, with the aid of the office computations, define and describe the item, or noting it over to one of the special parties; another is the cross-sectioning to determine the grading; a third includes the ballast tests, the tests for subsidence, the classification of the grading and the recording of condition notes, while a fourth is the field-office computations, in which the field notes are figured and summarized for transmittal to the Washington office.

Two men chain the line first, marking on the rail all the necessary pluses. They chain the main track or base line, and if necessary any spurs leading to industries. In general they keep no notes. Behind them follow the recorder and the cross-section group, working independently. The latter party, generally consisting of three, takes cross-sections of the roadbed as often as is deemed necessary. In the smooth country visited by the writer a hand level, tape and level rod sufficed, simple four-point sections being taken. In more rugged country, with deep rock cuts, slope boards or other special instruments are resorted to. Grading for station grounds, road crossings and borrow pits is recorded separately.

The recorder works alone while the chaining is being done, picking up the pluses and recording the items and types on the note forms with which he is equipped. To him falls the task of noting every fixed item of the railroad plant other than the grading and ballast, of noting changes in the track itself, and of defining everything in his notes, or indicating it on a memorandum for the bridge or one of the other special branch parties. As his progress is much slower than that of the chaining party, after the chaining is well advanced one member of the latter party accompanies and assists him a good part of the time, while the other usually assists the computers in the office car.



D. V. Form No. 510

INTERSTATE COMMERCE COMMISSION

DIVISION OF VALUATION

Page ....

Date ....

Carrier ....

Valuation Section ....

.... for Carrier

.... for I. C. C.

MAIN-TRACK SUMMARY. Mile .... Station .... to Station .... Length ....

Deduct for Bridges, Switches, and Crossings ....

Net Length for Track Ties ....

8. Ties ....

9. Rails ....

THE COMPUTERS IN OFFICE CAR SUMMARIZE FIELD INFORMATION ON THIS FORM

The ballast and subsidence investigations are made jointly by the assistant field engineer, who is in charge of the track and roadway party, and the railroad's representative. A railroad laborer accompanies them with the necessary equipment, and they usually cover several miles of road a day. Ballast depths are determined by digging. On the line visited by the writer, where the ballast was cinders, and where there was considerable soft ground, 1-in. iron-pipe sections were being used to advantage for determining subsidence. Coupled together they could readily be driven through the ballast and the embankment, and the total depth determined. By comparison with the cross-section notes the relation of this to the original ground surface was ascertained, and the depth of subsidence determined. If there seemed to have been considerable subsidence, and the government and railroad representatives disagreed as to the amount, a wash boring was taken at that point.

This party also has its laborer dig to determine the depth of masonry foundations, where plans are lacking or there is disagreement. In other cases, however, where digging or sounding is impracticable or there is disagreement, an agreed depth is determined upon from careful examination.

Necessarily the task of the recorder is a complex one. Every effort has been made to simplify this by note forms and type symbols. Some of the headings are shown. A notable feature of most of them is the liberal provision of blank headings, so that by filling these in, in conjunction with the type symbol, everything under the general classification can be recorded without elaborate descriptive notations.

It is necessary, of course, to draw definite lines between the structures which are inventoried by the track and roadway parties and those which are left for the special branch parties that come later. It will be noted from the sample memoranda sheet that the recorder must state definitely whether or not he has enumerated each structure in which the special party might be interested, thus removing all doubt as to whether it has been inventoried.

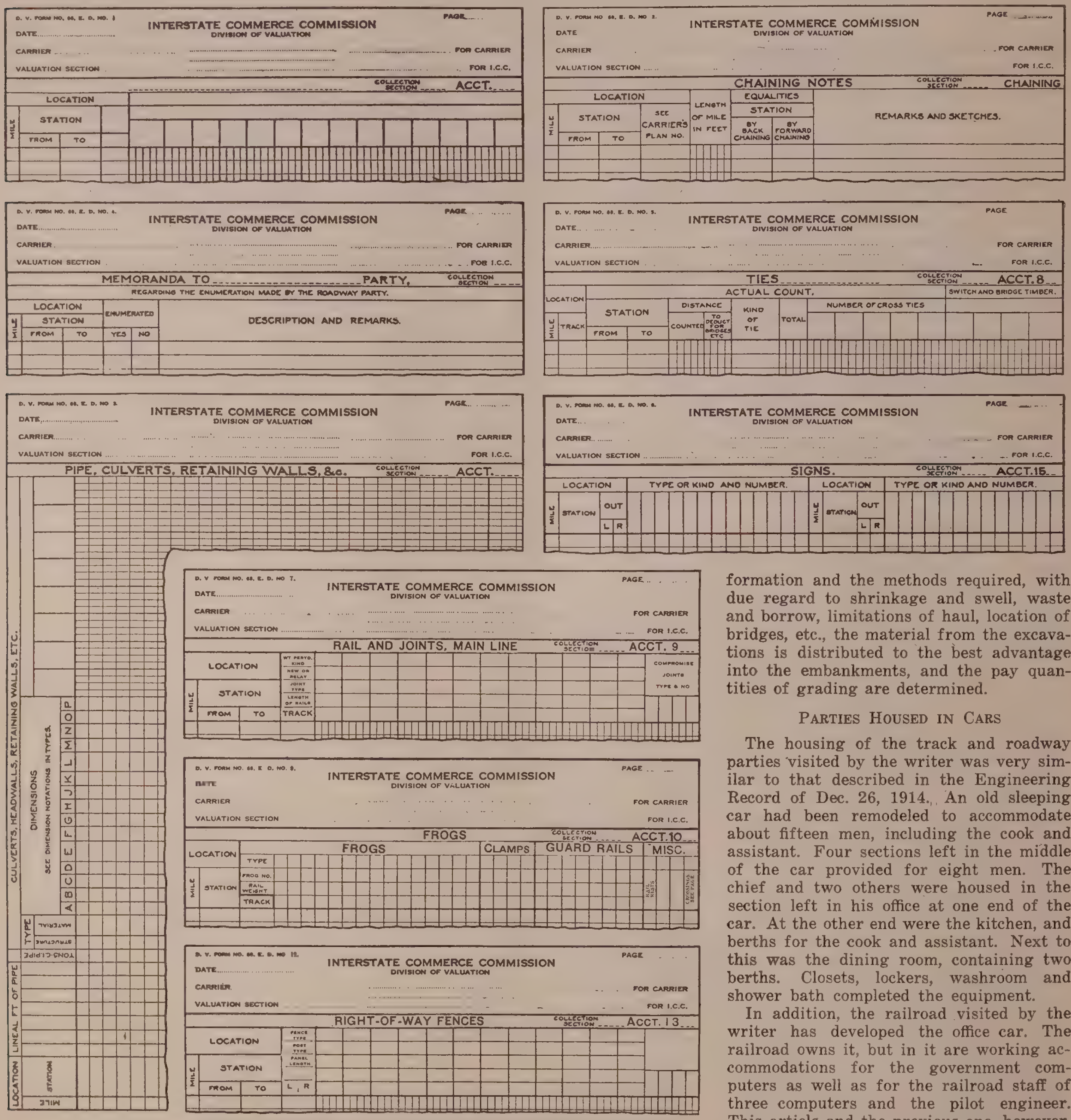
The recorder is equipped with two classes of type sheets. He has several type A sheets, which show structures common to all railroads, identified by index symbols. These include sketches which interpret the dimension letters on the form shown for culverts and retaining walls. In addition he has special type sheets, showing standards of the particular road under valuation.

DUPLICATE NOTES MADE IN FIELD

These note forms are ultimately $8\frac{1}{2}$ x 11 in. The original and the carbon are made in one sheet, the original folded over the carbon on a line of perforations at the right-hand edge. On the bottom sheet (carbon copy) is an extra, detachable margin of $1\frac{1}{4}$ in., with holes for binding in the original field book, so that the recorder can readily transfer his sheets and carbon paper in the field. When these notes are turned in the extra margin is torn off, and other holes in both original and carbon permit binding separately. The original sheets are ruled in green and the carbons in red. Each sheet, it will be noted, has blank spaces for the signature of both the carrier's and the government's representative.

The recorder has all of his forms, with a day's supply of blank sheets, fastened in a binder. The sheets for each I. C. C. account are separated by wire clips. The inventory by accounts ordinarily requires handling about fifteen forms. He must, for instance, have three separate forms for culverts, since they may be classified under I. C. C. accounts 3A, 6A or 15A according to their purpose. In addition he has standard blank note sheets, ruled 10 x 10 or 5 x 5, also with carbons, for special sketches. At the back he has his type sheets with thumbnail indexes. He also carries a pocket type, a folding rule and a tally register. His equipment is cumbersome for cold or windy weather, but it is difficult to see how it could be simplified. When one of the chainmen is assisting the notes are divided.

As the inventory and cross-section notes are completed they are turned over to the computers in the office car, and computed and summarized. Ties are figured from a count by the recorder of two 600-ft. stretches in each mile. Linear feet and tonnage for each rail weight are computed from the survey stations and pluses. Joints are figured from the rail lengths. Types are recorded by symbols.



D. V. FORM NO. 68, E. D. NO. 1
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
COLLECTION SECTION ACCT.
LOCATION
MILE
STATION
FROM
TO

D. V. FORM NO. 68, E. D. NO. 2
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
CHAINING NOTES
COLLECTION SECTION CHAINING
LOCATION
MILE
STATION
FROM
TO
SEE CARRIER'S PLAN NO.
LENGTH OF MILE IN FEET
EQUALITIES
STATION
BY BACK CHAINING
BY FORWARD CHAINING
REMARKS AND SKETCHES.

D. V. FORM NO. 68, E. D. NO. 4.
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
MEMORANDA TO PARTY,
COLLECTION SECTION
REGARDING THE ENUMERATION MADE BY THE ROADWAY PARTY.
LOCATION
MILE
STATION
FROM
TO
ENUMERATED
YES
NO
DESCRIPTION AND REMARKS.

D. V. FORM NO. 68, E. D. NO. 5.
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
TIES
COLLECTION SECTION ACCT. 8
LOCATION
MILE
TRACK
ACTUAL COUNT.
STATION
FROM
TO
DISTANCE
COUNTED
TO DEDUCT FOR BRIDGES ETC
KIND OF TIE
TOTAL
NUMBER OF CROSS TIES
SWITCH AND BRIDGE TIMBER.

D. V. FORM NO. 68, E. D. NO 3
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
PIPE, CULVERTS, RETAINING WALLS, &c.
COLLECTION SECTION ACCT.
CULVERTS, HEADWALLS, RETAINING WALLS, ETC.
DIMENSIONS
SEE DIMENSION NOTATIONS IN TYPES.
A B C D E F G H J K L M N O P
TYPE
MATERIAL
STRUCTURE
TONS-C.I.PIPE
LINEAL FT OF PIPE
LOCATION
STATION
MILE

D. V. FORM NO. 68, E. D. NO. 6.
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
SIGNS.
COLLECTION SECTION ACCT. 15
LOCATION
MILE
STATION
OUT
L
R
TYPE OR KIND AND NUMBER.
LOCATION
MILE
STATION
OUT
L
R
TYPE OR KIND AND NUMBER.

D. V. FORM NO. 68, E. D. NO 7.
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
RAIL AND JOINTS, MAIN LINE
COLLECTION SECTION ACCT. 9
LOCATION
MILE
STATION
FROM
TO
WT PER YD. KIND
NEW OR RELAY
JOINT TYPE
LENGTH OF RAILS
TRACK
COMPROMISE JOINTS TYPE & NO

D. V. FORM NO. 68, E. D. NO. 9.
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
FROGS
COLLECTION SECTION ACCT. 10
LOCATION
MILE
STATION
TYPE
FROG NO.
RAIL WEIGHT
TRACK
FROGS
CLAMPS
GUARD RAILS
MISC.
RAIL RESTS
CROSSINGS SEE PAGE

D. V. FORM NO. 68, E. D. NO 12.
INTERSTATE COMMERCE COMMISSION
DIVISION OF VALUATION
PAGE
DATE
CARRIER FOR CARRIER
VALUATION SECTION FOR I.C.C.
RIGHT-OF-WAY FENCES
COLLECTION SECTION ACCT. 13
LOCATION
MILE
STATION
FROM
TO
FENCE TYPE
POST TYPE
PANEL LENGTH
L R

THESE AND OTHER SELF-EXPLANATORY NOTE FORMS SIMPLIFY RECORDER'S TASK

One feature of the notes transmitted to the Eastern District office at Washington is the volume diagram prepared by the roadway party for the use of the district office in determining the pay quantities of grading. After the cross-section areas have been determined, with or without platting, according as they are simple four-point sections or more complex, they are used as the ordinates and the linear distances between the cross-sections as the abscissas in constructing this diagram, which is platted on "Plate A" profile paper. The areas representing volume are platted above the selected base line for excavations and below the base line for embankments. Subdivisions of the total volumes on account of classified materials, borrow, waste, quantities chargeable to other accounts, etc., are indicated by interior lines on the diagram showing the partial volumes. The diagram is then planimetered for volumes in the field office, as are all quantities of grading to whatever account chargeable, and all available information which may influence the determination of pay quantities is shown thereon.

In the district office the diagram is taken in hand and from a careful study of the information and the methods required, with due regard to shrinkage and swell, waste and borrow, limitations of haul, location of bridges, etc., the material from the excavations is distributed to the best advantage into the embankments, and the pay quantities of grading are determined.

PARTIES HOUSED IN CARS

The housing of the track and roadway parties visited by the writer was very similar to that described in the Engineering Record of Dec. 26, 1914. An old sleeping car had been remodeled to accommodate about fifteen men, including the cook and assistant. Four sections left in the middle of the car provided for eight men. The chief and two others were housed in the section left in his office at one end of the car. At the other end were the kitchen, and berths for the cook and assistant. Next to this was the dining room, containing two berths. Closets, lockers, washroom and shower bath completed the equipment.

In addition, the railroad visited by the writer has developed the office car. The railroad owns it, but in it are working accommodations for the government computers as well as for the railroad staff of three computers and the pilot engineer. This article and the previous one, however, have been confined to what the government is doing in the valuation work. What some of the railroads are doing will be the basis for other articles.

The two cars, living and office, are kept as near the work as practicable. The work visited by the writer was on a single-track line on flat country. At times the three groups were miles apart, and each group was able to cover a number of miles each day. Consequently it was futile to attempt to follow them too closely with the cars.

Arbitration by Engineers Saves Time and Money in Sewer-Valuation Case

Board of Three Members Reaches Unanimous Decision at Hanover, Pa., in Six Weeks, Eliminating Necessity of Retrial

By FARLEY GANNETT
Consulting Engineer, Harrisburg, Pa.

AFTER valuations by viewers and common pleas jury, and reversal by the State Supreme Court, the valuation for purchase of the plant, property and business of the Hanover Sewer Company at Hanover, Pa., was set on Feb. 28, 1916, by three engineer arbitrators, from the unanimous decision of whom it was agreed no appeal would be allowed. This case was brought previous to the formation of the Public Service Commission; otherwise it would have come before that body.

The borough of Hanover, with a population of 7057 in 1910, determined in 1913 to purchase the sewer system and disposal plant, built in 1902-1903 and owned by the Hanover Sewer Company. Viewers were appointed, as prescribed by the Act of 1901, and their report placed a value of $75,000 on the property. The Hanover Sewer Company and the borough of Hanover both appealed from this finding and the case came for trial in the Common Pleas Court of York County in March, 1914. As a result of this trial the jury placed a valuation on the property and business of the company of $119,454.54.

CASE IS APPEALED

From this verdict the borough of Hanover appealed, and on Oct. 4, 1915, the State Supreme Court upheld the appeal and reversed the judgment, ordering a retrial. The Supreme Court held as follows:

> In the present case the defendant company was undoubtedly entitled to compensation for the value of its business as a going concern and for whatever its franchise could actually be shown to be worth. But it must be remembered that it had no perpetual privilege, and permission to operate was granted to it only under the express provisions of the statute which empowered the municipality to become at any time the owner of the sewerage system and to take over the property of the company by paying the actual value at the time of taking. The sewer company had the right to carry on its business in the borough only until such time as the municipality chose to exercise its right of purchase. It is difficult to see how there could be any appreciable amount of value in such a determinable franchise as that. The company must be regarded as having accepted the privilege of constructing and operating a sewer system upon the condition that it would sell that system and the property used in connection therewith to the municipality for its fair and reasonable value, at the time when the municipality should see fit to take it over.

The court also stated that "if the going value of a concern is to be fixed, in part, by including losses in operation, then a premium may be placed upon poor judgment, misfortune or bad management. The greater the loss the greater would be the value of the plant. Such a theory cannot be accepted as sound."

Following the order for a new trial the two parties to the controversy agreed to have three engineers set the value of the property and business of the Hanover Sewer Company, stipulating that there must be a unanimous report, in which case there would be no appeal.

The company and the borough appointed their representatives in Dec., 1915, and the third member was selected by these two on Jan. 15, 1916. The board of arbitrators was composed of Alfred E. Forstall of New York, Farley Gannett of Harrisburg, Pa., and Ezra B. Whitman of Baltimore, Md.

The board met first at Hanover on Jan. 26, 1916, took some testimony on points which were not made clear by the evidence given at the trial, and inspected the town and disposal works.

After several meetings the board of arbitrators on Feb. 28, 1916, agreed upon a valuation, based principally on the evidence presented at the common pleas trial, of $85,400, plus $4587.85, being the amount expended for extensions since the original trial.

The board of arbitrators found that the original cost of the property, partly actual and partly estimated, was $67,600. The reproduction cost was placed at $79,630 and depreciation at $7,580, giving a reproduction less depreciation value of $72,100.

The award of the arbitrators is $13,300 in excess of the reproduction less depreciation cost, and $17,800 more than the original cost. Both of these costs include allowances, over and above inventory cost, for engineering, contingencies, organization, administration and interest during construction.

DECISION IN SIX WEEKS

Had this case not been arbitrated the retrial would probably have been held in the March term of 1916, when the entire case would have been reopened and all the old testimony presented again. If either side were dissatisfied with the verdict appeal could have been taken and several more years might have elapsed before final adjudication was reached. By the method employed a final decision was reached about two months after the two arbitrators were appointed, and in six weeks after the third was selected. The cost was undoubtedly far less by this procedure than it would have been had retrial been resorted to.

The sewer company constructed its plant 14 years ago, and to-day about one-third of the houses on its lines are connected to the sewers. For many years the revenues were so small as to require the borrowing of money to pay bond interest, and in this way a large accumulated deficit was formed, represented by outstanding notes for about $50,000. The existence of this note issue to cover annual deficits doubtless influenced the jury in making its award of $119,454.54. A sewer connection is not so essential as a water supply tap, especially in a limestone region, where a privy pit dug almost anywhere will carry off sewage. Thus, while the water utility in such a town may be successful, in the absence of an ordinance or state mandate to require sewer connections, a sewer utility may languish.

In 1913 the rates were raised by the sewer company, nearly doubling the earlier rates, and since that time a much better financial showing has been made. Some connections were lost as a result of the increase in rates, but the rate of increase of new attachments was, after the first loss, nearly as high as with the lower schedule. The attorneys for the borough claimed that had the suit for condemnation of the plant not been pending the reduction in consumers would have been greater. The probabilities are that for the last several years the new consumers added have been confined more or less to newly-erected houses.

The following tabulation gives a good idea of the proceedings gone through and the various awards and decisions:

Tribunal	Award	Date	Appeal
Viewers	$75,000.00	October, 1913	By both sides
Common Pleas Court Jury.	119,454.54	March, 1914	By borough
Supreme Court	New trial ordered	Oct. 4, 1915	
Arbitrators ..	$85,400.00*	Feb. 28, 1916	No appeal by terms of agreement

*$4,587.85 to be added for work done since first trial.

There is no desire to suggest that engineers replace the courts and public service commissions in setting the values of public utilities, but it is desirable to illustrate the advantages derived in this particular case, which may apply to other similar cases. The arbitrators in the Hanover case had the decision of the Supreme Court to guide them legally; otherwise it would not have been so practicable a method of procedure. They also had the benefit of the printed testimony given at the court trial.

ANOTHER CASE

The writer had a quite different experience in another arbitration case involving a dispute for extras between a city and a contractor on a large concrete intercepting sewer. In that case the board of arbitrators was composed of a contractor, an engineer and a banker. The two parties agreed to accept the decision of this board without appeal, and it was necessary to take complete testimony under court rules and to hear arguments of attorneys. On account of the difficulty of arranging dates to suit attorneys and arbitrators the case dragged for 18 months and proved costly for expert witnesses, lawyers and arbitrators.

The writer believes that for purely technical cases, where important legal points are not involved, and if appeal is prevented by agreement, arbitration by engineers will save time and money, particularly if the board of arbitrators is permitted to direct the case, arrange sittings and limit discussion and argument. It is also believed that in such instances as the Hanover sewer case, where the law is clearly defined by previous trial and Supreme Court decision, final settlement of valuation by engineer arbitrators, where the jurisdiction of public service commissions does not apply, will usually give satisfactory results.

Unit Stresses in Design of Brooklyn-Brighton Viaduct, Cleveland

An error was made in the description of the design of the Brooklyn-Brighton viaduct in the issue of June 24, page 833, in stating that the beams and columns were designed in accordance with the values allowed in the Cleveland building code. Instead, the unit stresses were based upon formulas as given in the proposed revised form of this building code adopted by the committee on revision, but not formally accepted and passed as part of the Cleveland code.

Give Skin-Friction Data on Shaft Sinking in Chicago

DATA on skin friction encountered in sinking shafts in Chicago to connect to the separate water pipe and conduit tunnel at LaSalle Street paralleling the street railway tunnel under the Chicago River have recently become available, although the work was completed several years ago. The shafts are 10 ft. in internal diameter and about 98 ft. deep below street grade. At the north end the shaft was located on the east side of the street within 2 ft. of the footing course of a seven-story building, and the west side abutted against the piling of the old abandoned tunnel. To protect the building the shaft was started with a 25-ft. length of ⅜-in. steel shell 11½ ft. in diameter, made up of 5-ft. sections, field-riveted to the portions already sunk. Butt joints were used on the outside face and the rivets were countersunk. The shelf of the shoe was made up of a ½ x 9-in. plate, set back 12 in. from the cutting edge. The caisson was supported by four 1½-in. rods, which passed through the shelf and were held at the top by timbers laid across the opening. A single 9-in. ring of brick was built on the shelf and carried up to the top as the shell was lowered.

It required a loading of about 200 tons to start the shell when 15 ft. of its length was in bearing against the clay. The weight was made up as follows: Shell, 12 tons; brickwork, 28 tons; pig iron, 52 tons, and sandbags, about 108 tons. The rate of movement was 10 ft. in four days, and when once started the shell kept moving without additional loading. The material was soft blue clay, and the skin friction based on these weights is 740 lb. per square foot at the start and 440 lb. per square foot when the full 25-ft. length was in bearing and the shell in motion. The classes of material encountered were as follows: Soft blue clay, — 16 to — 31; hard picking clay, — 31 to — 61; hardpan, — 61 to — 75; hardpan and boulders, — 75 to — 85; sand, below — 85; rock usually found at — 90 to — 92.

Below the steel shell the shaft was excavated in 5-ft. sections. The brick walls were increased to 16 in. and supported from the shoe of the caisson by seven 1-in. hanger rods passing through the shelf and carrying at the lower end 10 x 10½-in. plates upon which the brickwork rested. Under the supporting plates 6-in. sleeve nuts were used in place of ordinary nuts and furnished means of adding to the rods after excavating the succeeding sections. To provide additional bearing and take some of the load from the hanger rods, about every 3 ft. in depth two courses of brick were set back into a 4-in. rabbet excavated in the clay.

In sinking the shafts and driving the tunnel it was desirable not to penetrate the sand which overlies the rock, as this usually carries water. Soundings made before the final depth planned for the shafts was reached showed that sand was about a foot higher than anticipated. The grades of tunnel and shaft bottoms were accordingly raised sufficiently to keep out of the sand.

Coke Production

The coke made in the United States in 1915 amounted to 41,581,150 short tons, an increase, as compared with 1914, of 7,025,236 tons, and within 5,000,000 tons of the record output of 1913, according to the U. S. Geological Survey.

U. S. R. S. Project Manager's Duties Defined

Numerous Accomplishments Necessary Include Those of Financier, Diplomat, Engineer and Lawyer

IN AN OUTLINE of the diversified duties of the project manager in the U. S. Reclamation Service D. W. Cole, in the July *Reclamation Record*, indicates that engineers who aspire to these offices will find the "outside" accomplishments quite as necessary as those taught in college. Mr. Cole classifies the duties into engineering, superintending, inspecting, judicial, diplomatic, advisory, fiscal, formal and clerical.

As an Engineer

In his engineering capacity the project manager strives in his way to become that ideal engineer who scientifically organizes, correlates, unifies and directs the efforts of mankind through the forces of nature for the greatest efficiency in the accomplishment of human happiness. Specifically for his project this engineer prepares or supervises the preparation of plans, specifications and estimates for carrying on all construction work, either by contract or by his administration forces.

As a superintendent he organizes and controls the force of "water masters," "canal riders," foremen and laborers—with teams and machinery as required—for the operation and maintenance of the irrigation and drainage systems.

His inspection duties include the examination and approval or rejection of all work in progress, whether done by contract or "force account," as well as the review of irrigation and farming practices which come within his influence for progressive efficiency.

Judicially he holds his little quasi-court for considering and passing upon the innumerable small questions of law and regulations which govern the relations between the Reclamation Service and its constituents, the "water users."

As a Diplomat

The dexterity and finesse of the accomplished diplomat are needful to a project manager who essays the settlement of disputes over water. A man may be a reputable Christian gentleman and still be a "water hog." But the qualities of tactful negotiator must carry the project manager beyond the petty squabbles of irrigators into the field where necessarily conflicting interests must be reconciled in the form of contracts for settlement of permanent water rights, boundaries of lands, definition of privileges, and values of property in general.

His advisory function includes, on the one hand, both the spoken and written aid and comfort to his widespread community of water users, on all conceivable subjects, and, on the other hand, his conferences and reports in which he discusses with government officers all the policies and practices of the complex community life in its relations to the construction, operation of and payment for the irrigation system.

As a Fiscal Agent

As a fiscal representative of the government he is charged with knowledge of and responsibility for the funds allotted to his project. He must specify and supervise purchases, guard expenditures, secure collections, scrutinize all money transactions, certify payrolls, execute contracts, examine the balance sheet and approve all vouchers in advance of payment.

As a clerk, recorder, statistician and historian of project affairs the manager completes his round of duties and finds scope for any remaining energy in his soul.

While the activities suggested in the foregoing outline might be supposed to occupy his time, the manager, moreover, must find time at frequent intervals to entertain official or casual visitors, escort distinguished guests over the project, attend public meetings for giving account of his stewardship to water users or to explain to public bodies the policies, plans or accomplishments of the government; to serve on committees or boards of directors for conducting county affairs, municipal celebrations or state functions, or merely sit in his office and look pleasant while being interviewed or appealed to by reporters, farmers, agents, promoters, investigators or just plain cranks armed with letters of introduction.

Combines Engineering and Business Courses

To Meet Demand for Technically Trained Managers in Manufacturing, Public Utility and Sales Lines

FOR SOME YEARS the College of Applied Science of the University of Iowa has offered a general engineering course four years in length for men who might wish to go into contracting rather than into technical engineering work. A number of men have taken the course, and have done well as contracting engineers. On account of the demand for managers in manufacturing, public-utility, municipal and sales lines, where a combination of technical and business training is advantageous, two new courses have been established. Instruction in them will be begun next September. One combines business with chemistry and the other business with engineering.

A considerable number of electives in engineering subjects is permitted, so that the student may specialize in whatever phase of engineering interests him most—the mechanical, the electrical or the civil field.

The subjects taught and the time allotment to them are given in the following table:

Combined Course in Engineering and Business

	Hr.
General Subjects:	
Mathematics	10
Chemistry	8
Metallurgy	6
Physics	12
English	10
Municipal government	3
Electives	12
Total number of hours in general subjects.	61
Engineering Subjects:	
Engineering drawing	5
Surveying	3
Mechanical engineering	5
Electrical engineering	6
Approved electives	23
Total number of hours in engineering	42
Business Subjects:	
Elements of economics	3
Elementary accounting	3
Accounting practice	3
Economic geography	2
Raw materials of commerce	2
Labor problems	2
Business efficiency	3
Business organization	3
Business law	2
Commercial law	2
Approved electives	8
Total number of hours in commerce courses	33
Total number of hours required for the degree	136

Instrument Plots Profiles of River and Harbor Beds

First of Three Hydrographic Instruments Devised by Argentine Engineer Is Mounted on Boat and Records Soundings Automatically

THREE devices have been developed by Agustin Mercau, an engineer of the Argentine Republic, which have greatly facilitated hydrographic work undertaken by him in that country. The first of these, named the Profilograph, will take a profile of harbor beds, river bottoms, etc., under conditions of weather that would make sounding operations impossible. This article will deal with the Profilograph. His Autophanograph, which maps the route traversed by a boat, and his registering hydrometer will be described subsequently.

THE PROFILOGRAPH

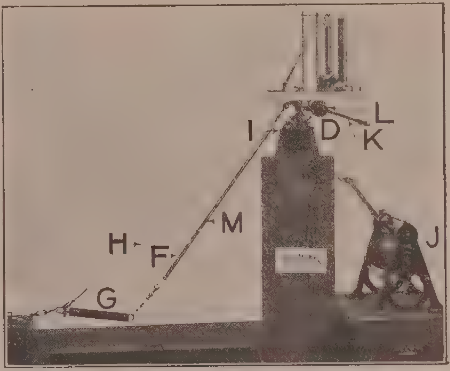
For taking profiles the Profilograph is installed in the bow of a boat, in its symmetrical plane. The depths are obtained by recording on a roll of paper the sines of the angles that a bar, movable about a horizontal axle, describes. This bar is guided by a light steel wire of constant length, held at tension by means of a weight constantly above the bottom, which is dragged along according to the movement of the boat.

A simple rigid bar is substituted for the wire when the apparatus is used as a tide gage, or is operated in small depths. In the first case, the apparatus is fixed, and the free extremity of the bar is equipped with an attached float. In the second case, it is made to slide above a prescribed horizontal. Due to the variations of the level of the water or to the irregularities of the bottom, the bar will describe variable angles with respect to the horizontal. The sines of these are the depths that it is desired to record, referred to the horizontal plane that passes by the axis of rotation of the bar.

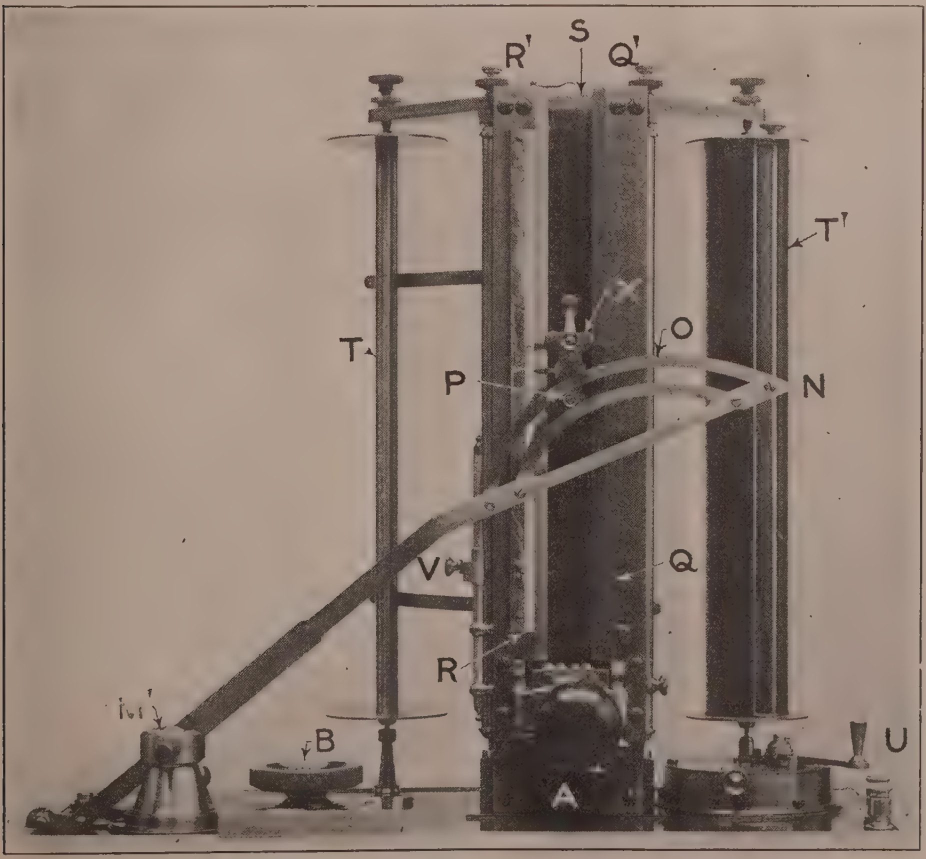
PENCIL SKETCHES PROFILE

In all cases, the bar designated in the accompanying illustration by the letter *M* moves, by a simple arrangement, a shorter bar (*M′N′*, Fig. 2)that carries on its free end a curved guide (*O*) of determined equation. This moves about a pencil that is also movable, by means of a small swivel that slides guided by the uprights *QQ′* and *RR′*. The shorter bar transforms the angular movement of the long bar in another straight line, proportional in length to the sines of the angles described by it. The pencil (*P*) is moved above a band of paper that passes constantly before an upright plane, which is placed in movement by a clock-work mechanism contained in the box *U*, which makes it pass, on the cylinder, from *T* to *T′*.

The pencil sketches in this manner a continuous line that represents a profile of the bottom. The vertical scale of the diagram so obtained depends on the relations between the point of application of the weights, the axle and the full length of the small bar. In dealing with a profile, the horizontal scale is deduced by establishing the relation between the distance between two points or successive tops and the distance covered by the boat. This is on the supposition that the speed of movement of the paper as well as that of the boat will be constant. Such conditions are attainable by practice. The clock-work mechanism is provided with features that assure the uniformity of its movement. Warning is given when its power is diminishing by a small bell that is actuated by electric contacts. In order to have a line of reference for the diagram, another pencil is fixed on one of the vertical uprights. This travels a straight line horizontally on the paper.



THE PROFILOGRAPH



DIRECT READING MAY BE OBTAINED BY MEANS OF FIXED INDEX

IMPORTANT POINTS CAN BE MARKED ON DIAGRAM

An automatic numerator permits the recording of each important point in successive numbers.

A metal scale, fixed on the upright *RR′*, permits the direct reading of the depth by means of an index that is connected to the swivel that moves the pencil *P*.

The apparatus can be turned about on the vertical axis, thus making it possible to correct the deviations of the boat with respect to the line, by means of the screws indicated by the letter *D*. The wire (*F*) is united to the balancing weight by means of a steel spring (*G*) that permits the graduation of its tension up to the limit that is desired. This is effected by means of a steel cable (*H*) of greater section, called the cable of security, which is likewise united to the weight, and which, after passing by the pole of direction (*L*), can be manipulated gradually by the small winch (*J*). The weight is of old chain of large mesh.

TENSION PUT ON CABLE BY WINCH

To give the wire the length and tension desired, for on the length of it the vertical scale of the diagram depends, a length of cable is laid out by means of the winch (*J*) so measured that the sum of its length and two-thirds of the length of the arresting weight will be proportionate to the scale that is desired. An equal length of the steel wire is let out at the same time. When the cable of security has been completely unrolled, and is fixed in place by screws to the small cylinder (*L*) a slight tension is put on it by turning the handle *K*. Then, by the same means, a further tension is added until a certain quantity of stress is produced, equal to that of the spring *G*, which is the maximum tension to which it is desired to submit the wire.

In this manner, and because the resistance to the dragging of a much greater weight, the wire remains submitted to a constant tension that can in no case be exceeded, since to do so would break it. The speed of movement should not exceed 6½ ft. per second in order to avoid having the weight raised by virtue of water resistance, and thus have an appreciable influence on the wire and alter, by such means, the indications of the apparatus.

Signs Keep Up Water Standard

All through the purification plant of the Terre Haute Water Company are such signs as "Purity First" and "Keep Up the Standard." Three shifts of operators keep the efficiency of the plant high.

Etching Test to Detect Steel in Wrought-Iron Pipe

Simple and Time-Saving Method for Preparing and Examining Specimens Requires No Special Technique for Satisfactory Results

AN ETCHING test believed to possess many advantages has recently been recommended as an aid in detecting the presence of steel in wrought-iron pipe. While it may be used in detecting steel in any of the commercial shapes of wrought iron, it is particularly suitable for the investigation of iron pipe, in which the presence of steel is a serious factor, since it affects the life of the pipe to a material degree.

The detection of steel by means of picric acid etching and a microscopic examination requires the preparation of a metallographic specimen, and is a tedious operation, involving the expenditure of considerable time and the exercising of great care. Even when the wrought iron contains a large percentage of steel, the steel contents will often be missed, as there is nothing to indicate where the metallographic specimen should be prepared for microscopic examination.

Locating Areas of Steel

The following etching test has been recommended because it eliminates this uncertainty and insures success in discovering any steel which might be mixed with the iron. No claim is made that it is in itself a conclusive test, but it does show up the areas most likely to contain steel, thereby eliminating the necessity for further search and enabling the investigator to proceed at once with the more elaborate preparation of the specimen for microscopic examination.

The procedure is as follows: Three or four sample rings, 2 or 3 in. long, are cut, preferably from different pieces of pipe or from different points on the same length of pipe. The rings are submerged, one at a time, in a solution consisting (by volume) of 25 per cent hydrochloric acid, 1.19 specific gravity; 25 per cent sulphuric acid, 1.84 specific gravity, and 50 per cent water.

After being left in the solution about one minute, the samples are rinsed in cold water and then with alcohol. Both ends of each sample are then examined for bright streaks, which are an indication of steel. An examination of the surface of the metal will not, as a rule, it is pointed out, show steel, as steel scrap is usually inserted in the middle layers of the fagot so as to prevent it from coming to the surface of the finished pipe. If no suspicious-looking streaks are found in the first ring etched, additional rings can be tried. Three or four rings will usually reveal the steel scrap, especially if rings cut from different pieces of pipe are available.

Testing for Steel

A flat should now be filed on the outside of the ring suspected of containing steel where the steel, according to the end indications, is most likely to be found. Filing should be stopped when the suspected steel band or bands are half filed away, or when their maximum surface is exposed. It is not necessary to polish the surface to be examined. The flat should now be etched, proceeding in the same manner as for the etching of the ends, keeping the sample in the solution one minute or as much longer as is necessary to bring out the steel bands in strongest relief. If it is desired to keep the etched surface from fading, it should be covered with white shellac or some other suitable non-acid coating.

If any doubt exists as to whether or not the bright streaks shown on the etched surface are steel, the surface should be polished to the highest possible mirror finish, free from scratches, etched with a 5-per cent solution of picric acid and alcohol, and examined by means of the microscope.

Summing up briefly, the advantages claimed for the above test are: (1) It eliminates much of the uncertainty incident to the use of the picric acid test alone; (2) it saves time in the preparation of the test specimens and in the examination of the etched surface, and (3) it requires only easily obtained materials and no special technique to make a satisfactory test.

This test is recommended and used by the A. M. Byers Company of Pittsburgh, manufacturer of wrought-iron pipe.

Indicate Latin-American Engineering Opportunities

Possibilities in South American Countries Brought Out at Conferences at Massachusetts Institute of Technology

WITH a large ratio of foreigners in its student body, and realizing the greatness of the opportunity that exists for American capital and American engineers in South America, the Technology Christian Association of the Massachusetts Institute of Technology, three years ago, initiated a series of conferences for the purpose of acquainting those in attendance with conditions and the possibilities in South American countries. The speakers, all South Americans, have been men already technically trained who have gone to the institute for the purpose of fitting themselves by advanced work for engineering service in the southern continent. Hardly any important country in South America has not been represented.

Survey of Continents Needed

At one of these conferences Antonio R. Guimaraes of Rio Preto, Brazil, spoke on some of the opportunities of Brazil. He outlined the enormous size of the country, and discussed the lack of surveys. The continent is practically unexplored except for comparatively small areas, and the first essential for all the countries is a survey on the lines of those conducted in the United States by the Geological Survey. In Brazil surveys have been sporadic, as the industries needed them. In the Argentine there is a very expensive work under way by the military engineers.

Next in importance in the country is the extension of the railways. These are in much the same condition as those of the United States were in 1860. There are in Brazil about 14,000 miles, and they penetrate no farther relatively than Cleveland, Ohio, into a country 200,000 square miles larger than the United States. Areas are enormous, the rubber districts being 400 miles from the end of the railway, which itself extends inland 1400 miles from the coast.

One of the great possibilities in South America lies in water-power development. Here there is an enormous opportunity, generally, however, far distant from civilization.

Mr. Guimaraes spoke also of the irrigation possibilities, and stated that in point of canals Holland is likely to be outdone by the mountain portion of Brazil. Here the aborigines had very extensive plants for irrigation, and these may be put into commission once more. Everywhere in the country there is opportunity for electric lighting and power engineering. His own city, according to the speaker, had a decade ago about 75,000 population, but now figures 450,000.

Pedro P. Pizzorno of Manaos, Brazil, made special reference to the climate of the country. It is exceedingly varied, since the republic extends from 2 deg. north to 32 deg. south of the equator. Brazil has been forward in sanitary matters. Yellow fever has been practically exterminated. The swamps have been treated so that malaria has decreased, and the grade of sanitation is quite on a par with that of the northern part of the hemisphere.

Land Reclamation Important in Peru

With reference to Peru, V. F. Checa of Piura called attention to the fact that when Pizarro came to the country there were about 80,000 natives who cultivated 250,000 acres, while the land in cultivation to-day is only a fraction of this amount. Reclaiming of land in Peru will vie with mining development as the important engineering work of the future.

In Chile the government offers engineering education free to its young men, and seeks to keep them in the country. The railway system totals about 4000 miles, and is owned and managed by the government.

Bolivian Mines

C. E. Atwood, an electrical engineer who has spent five years in South America, stated that its development is proceeding rapidly and that there is now opportunity for important work.

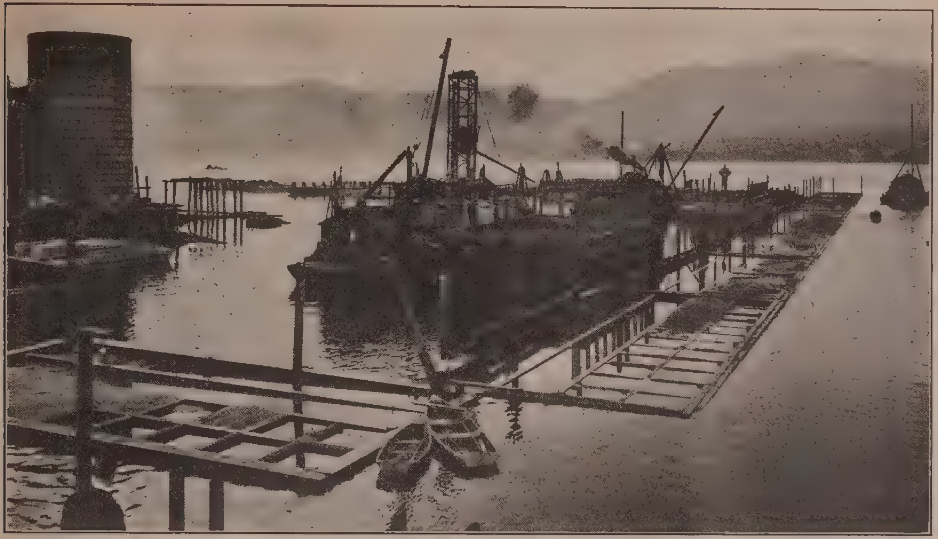
He also stated that the Bolivian mines have rich outputs, but much of the valuable metal is in small quantity, being low-grade ore. It is necessary to reduce this on the ground with imported machinery and export the refined product. There is a lack on the west coast of sources of power. There is no coal, little oil, and the water power is far removed. A large portion of the latter is in underground streams.

A young man without capital should get from business men, generally heads of commercial firms in New York, special information with reference to the different opportunities. The inexperienced man who lands in South America without letters may have some difficulty, but at all events a very varied engineering experience. As an electrical engineer Mr. Atwood went up into the country and found it necessary to do mechanical and hydraulic engineering work as well, as the exigencies of his position, far from outside resources, made these different demands on him. Salaries are large, but the cost of living is high.

In giving advice to any men thinking about starting for South America, Mr. Atwood said that Spanish is necessary in most places, but the language is easy. The North American should go south of the equator. Smallpox and typhoid are fairly common.

Fuel Briquet Production

According to the annual statement of the U. S. Geological Survey on fuel briquetting in 1915, now available for distribution, the production during the year was 221,537 short tons, valued at $1,035,716.



CRIBS WERE PLACED WITH GREAT ACCURACY ON DRAGGED BOTTOM

Concrete and Timber Cribs Accurately Placed for Vancouver Wharf

I-Beam Drag Levels Foundation for Dominion Government Pier, the Outer Walls of Which Are Made Up of 100 x 30-Foot Concrete and Timber Cribs

By R. MACKAY FRIPP
Vancouver, B. C.

INCLOSING 5½ acres of ground and providing at low water a depth of 35 ft., a wharf the outer wall of which is made up of timber and concrete cribs has recently been built for the Dominion Government at Vancouver, B. C. After the rock excavation for these cribs had been made, the bottom was covered with 2 ft. of broken stone, leveled with an I-beam drag operated from a scow. The cribs sunk on this foundation showed a maximum variation in line of only 3 in. and in grade of only 2 in. The cribs were built to a height of 10 ft. on ways, launched and completed in the water. A floating concrete plant, with a tower and chute, was used in their construction. The water space between the walls has been filled, leveled and rendered immediately available for trackage. The depth of water at low tide is 35 ft. The range of tide is 16 ft. East and west wings or bulkheads are built at the shore and to retain the filling, which is carried up to the tracks of the Canadian Pacific Railway. A grain elevator with 1,250,000 bushels capacity is in course of construction adjoining the shore end of the wharf.

Drill Scow Employed

Operations were commenced by excavating the stiff heavy clay and boulders which overlay the rock bottom, a dipper dredge being used. To deal with the rock a drill scow, 100 x 30 ft., was built and equipped with drill towers, the drills being 34 and 57 ft. in length. Additional weight was given to them by a 4500-lb. backing. The rock is of a conglomerate nature, closely resembling a coarse concrete of water-worn granite stones and cement and makes very hard drilling, the stones constantly breaking out from the matrix and filling up the holes, which, on this account, sometimes had to be drilled two or three times before they could be charged. The rock was taken out in two and in some places three lifts, depending on the depth; but not more than 12 ft. was taken out in any one lift, as it was found impossible to keep the holes jetted clean enough to allow the drills to work freely at a greater depth. Holes were charged with a hollow-tube pipe with a plunger running through it, the charges being fired by a battery. Single holes were sometimes fired, but a whole range 90 ft. in length by 12 ft. deep and 5 ft. wide was usually discharged at one time, yielding, roughly, about 200 cu. yd. at every shot.

The drill scow, which was the first of its type used in these waters, was set on spuds at each corner, and each spud was worked by a separate engine. As the tide rises and falls about one-tenth of a foot every five minutes, the spuds were constantly changed.

After completing the excavation the bed upon which the cribs rest was covered with a 2-ft. layer of broken stone. This was at first leveled by taking soundings with leads, but as the leads usually fell or slid off projecting stones, these projections above the level were not always registered, and the first crib placed upon sounded levels had to be raised. A new and novel method was then adopted. An I-beam was attached to a bridle on a scow, and cables secured to the back of the scow were passed beneath and fastened to the I-beam, which was then dropped to the grade and drawn backward and forward, after the manner of a harrow, until the bottom was rendered perfectly level. The effectiveness of this method is demonstrated by the fact that the greatest variation in the vertical joints of the western line of cribs did not exceed 3 in.; on the eastern line it was only ½ in., and the greatest variation in the levels of the tops of the cribs was only 2 in.

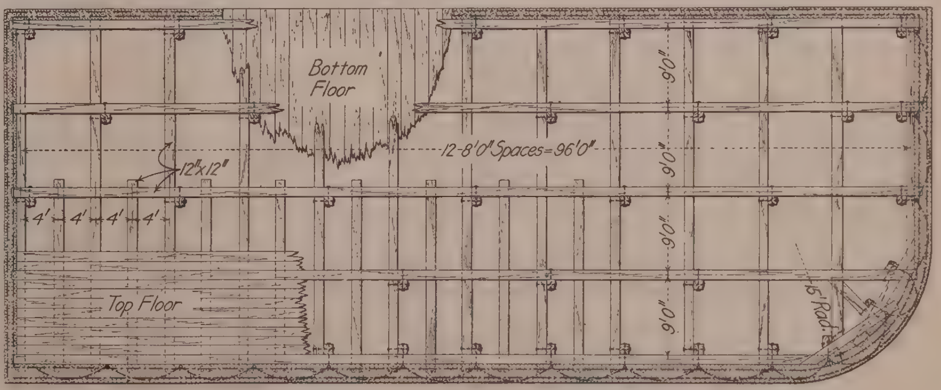
About 60 ft. from the north, or outer, end of the wharf the rock bottom dipped or ran out. It was therefore necessary to excavate to the rock and to fill and pack this space with stone up to the grade. At this point only has there been any settlement whatever, one crib moving outward at the top 2 in. and another 3 in. This settlement, however, occurred during the process of backfilling, when the load was constantly changing; but all settlement ceased when the backfilling was complete and the load became constant.

Details of Crib Construction

The construction of the cribs is as follows: A bottom platform was built of 12 x 18-in. fir timbers drifted together with 24-in. drifts at 3-ft. centers. A first course of 12 x 18-in. timbers was drifted to this bottom platform with 24-in. drifts at 3-ft. centers and machine bolts every 5 ft. The remainder of the timbers were drifted with 24-in. drift bolts. Vertical posts were placed at every intersection of longitudinals and cross-ties on the face of the crib and at every alternate intersection in the interior and the back of the crib. These posts were fastened to the longitudinals and cross-ties by machine bolts, nuts and washers. On the face of the crib these bolts were eye-shaped, the eye acting as a fastening for the bent rods of the concrete reinforcement. Cross-ties at 8-ft. centers extended 1 ft. through the face and 6 in. through the back of the crib. Fillers were placed between the cross-ties between the longitudinals, thus forming a solid wall. The longitudinals were set at 9-ft. centers and dovetailed 6 in. through the ends of the cribs. An extra cross-tie placed on the top of the crib made 4-ft. centers for the 12 x 12-in. decking drifted on to these timbers to serve as a foundation for the mass wall.

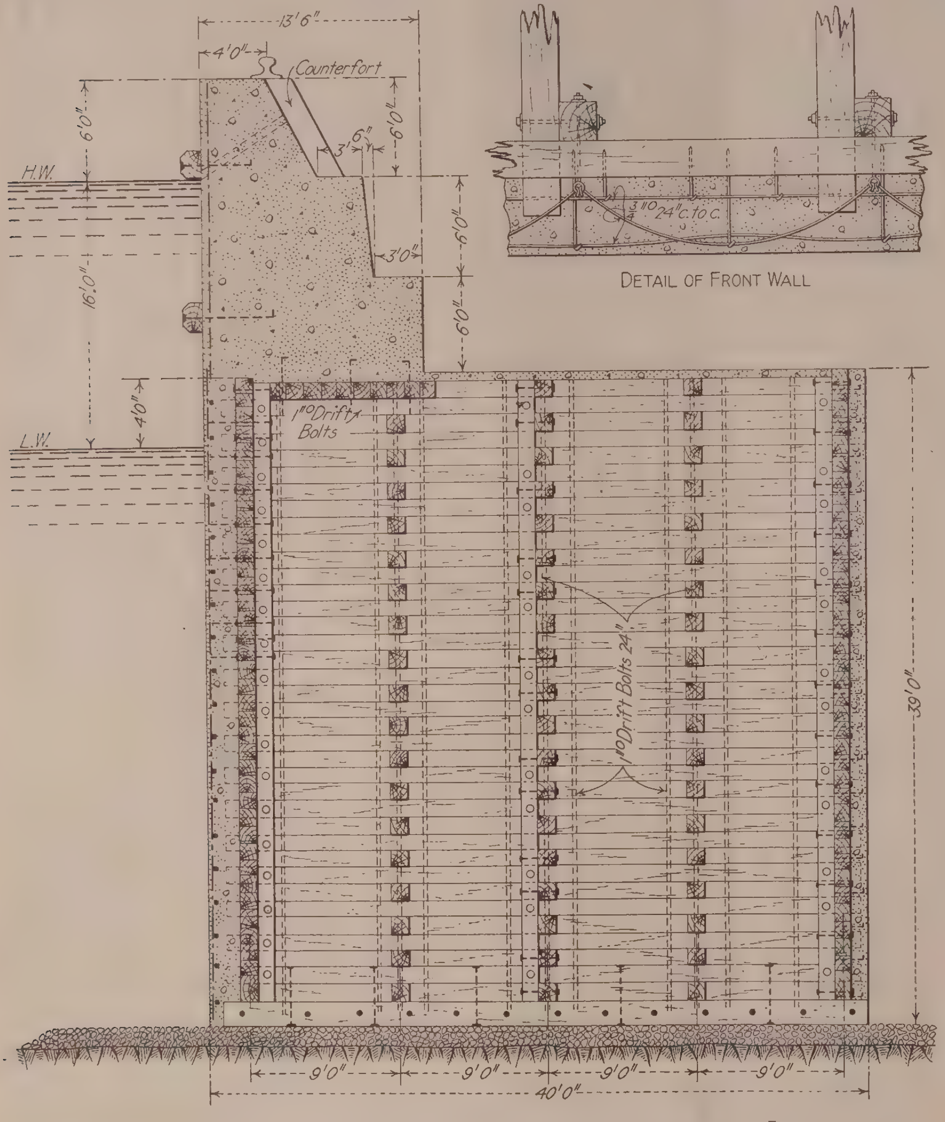
For launching the cribs, ways were constructed by driving piles at 10-ft. centers longitudinally and 8-ft. centers transversely. These were capped with 12 x 12-in. caps; the stringers were of the same dimension. The ways were 300 ft. in length, 100 ft. wide and given a 6.5-per cent grade. The outer ends of the ways were 1 ft. below low-water mark.

The cribs were built to a height of 10 ft. on a cradle placed at the back of the ways, which were furnished with hauling gear for



CONCRETE-INCASED CRIBS BUILT WITH ROUND CORNERS AT ANGLES OF WHARF launching the cribs. The cradle was capable of handling a crib 107 ft. in length. The cribs, after being thoroughly calked and sheathed with concrete, were brought to an even keel by ballast, and when launched drew a little more than 4 ft. 6 in. No difficulty was experienced in launching any of the cribs.

Concrete for sheathing was a 1:3:4 mix, and for the mass walls a 1:3:5 mix. All concreting was done by a floating mixer with a tower and the spouting system, the spouter being used direct on the mass walls. For the sheathing the spout discharged into a hopper and the concrete was distributed thence by buggies.



SOLID CONSTRUCTION SUPPORTS VANCOUVER WHARF WALL AND RETAINS 5-ACRE FILL

Material for the backfill, a mixture of sand and clay, was obtained by dredging at various points of the harbor, being clammed into flat scows and reclammed over the wall. The material, of which there was about 400,000 cu. yd., was leveled and kept back from the walls by means of a centrifugal pump with a 10-in. suction and an 8-in. discharge, and was able to handle the dirt to within 6 ft. of grade in the center of the wharf. The fill between the back of the wharf and the Canadian Pacific Railway track was made by cars on tracks, the clamshells discharging into a bunker, beneath which the cars were spotted.

A. W. G. Vassar is the engineer and Henry & McFee & McDonald the contractors.

New South Wales Irrigators Substantially Assisted

Money Advanced for Building, Planting and Stocking Farms from Two Acres Up—Expert Direction Also Given Settlers

NEW SOUTH WALES furnishes assistance to settlers on its irrigated lands in building homes and farm structures, in purchasing seed, fruit trees and stock, and in actually cultivating the land. The sums advanced may range up to more than $1,500. In addition, expert instruction is furnished to assist the settler in getting the maximum from his holding. In general a cash deposit is required, and repayment may be made on easy terms.

Assistance on Buildings

For the erection of houses on farms of from 2 to 4 acres, assistance is given to the extent of about $875; on farms from 5 to 10 acres, to the extent of $1,275, and on farms of over 10 acres as much as $1,500 may be advanced. Contracts may be made for "type houses," or the settlers may arrange with outside contractors for erection. On the first sum a deposit of 5 per cent is required on the building material when the settler provides all labor. For the second sum, a 10-per cent deposit is required, and for the third the deposit is 15 per cent. Repayments, with interest at 5 per cent, may be spread over either 10 or 12 years. For farm buildings material is supplied on easy terms. A deposit of 5 per cent is required and the conditions are as in the case of residences. The maximum amount of assistance on farm buildings is limited to $125 for farms of 2 to 4 acres, $250 for those of 5 to 10 acres, $385 for 11 to 25-acre farms and $500 for those of over 25 acres. Material to a value of less than $50 must be paid for in cash.

Assistance is given in the matter of fence posts at a rate of $25 per hundred, and for stays and strainers at 50 cents each. A deposit of 5 per cent is required and repayments may cover 10 years. Not less than 100 posts will be supplied on such terms.

Payments may be made for wire netting in periods covering from 12 to 24 months. For seed a deposit of one-third the amount is required and repayments may be spread over two years.

Assistance for Fruit Trees and Stock

Repayments for assistance for fruit trees is limited to one year. The maximum allowable is $150. A deposit of 25 per cent must be made. Repayments are payable in 5 years with interest charged at the rate of 5 per cent. Assistance is given to the extent of $5 per head for cows, and repayments may cover two years from the date of purchase. Allowance is also made for pigs and horses.

Assistance is furnished for cultivation to the extent of from $5 up to $250 per irrigable acre. The work must be carried out by contract. Should a settler desire to live in a cheaper house than that to which he is entitled under the regulations he may obtain additional assistance in his cultivation work. Repayments may be spread over 10 years.

Expert instruction is given settlers with the purpose of helping and guiding them in all branches of their farm work.

Suggests Leaner Grout as Remedy for Expansion Problems

Use of a grout filler less rich in cement than is usual was suggested by D. Moomaw, road engineer of Cuyahoga County, Ohio, as a remedy for one of the causes of expansion which, he asserted, would be present in the construction of monolithic brick pavements of the Paris (Ill.) type. "The greatest amount of expansion is brought about by the swelling of the filler under humidity changes," he declared at the annual meeting of the Ohio Engineering Society held at Columbus recently. "This expansion is in proportion to the amount of cement in the mixture. It will be reduced by reducing the grouting proportions to 1:1½ or 1:2. Since the wearing surface is provided with adequate bottom support, there will be almost an entire absence of vertical shearing stress on the filler, and hence it need not be of as great strength as would be required with a plain sand cushion. Also the regularly specified 1:1 mix for the grout was chiefly in anticipation of the segregation of the sand and cement, the rich mix being provided so that the chances of complete segregation would be less. With the more scientific methods of grouting, this segregation of sand and cement is practically eliminated and a leaner grout will serve equally well, if not better than the old method of mixing the cement and sand in equal portions and drowning it with water."

Subway Columns and Girders Designed to Support Future High Office Building

Heavy Foundation Grillages and Steel Slabs Used in Unusual Subway Construction at Site of Old Grand Union Hotel in New York City

WHERE the new subway construction passes under a corner of the plot at Forty-second Street and Park Avenue, New York City, the site of the old Grand Union Hotel, an unusual design problem was encountered by the engineers of the New York Public Service Commission. Provision had to be made for two conditions of loading on the roof of the subway—for a possible temporary backfill 28 ft. deep and for a future office building, which may be as high as twenty-five stories if of heavy construction, or even higher if of lighter construction.

The subway passes diagonally under one corner of the lot, increasing the difficulty in locating the steel bents for the roof in such a position that the future building columns could be directly supported. Fortunately, the angle between the tracks and the building lines was approximately 45 deg., so that the problem was solved by selecting such column spacing in each direction as would make diagonal lines between columns coincide with subway bents. The bents could thus be given a spacing equal to half the diagonal length between the building columns and these building columns carried directly upon the girders or in a few cases directly by the columns of the steel bents.

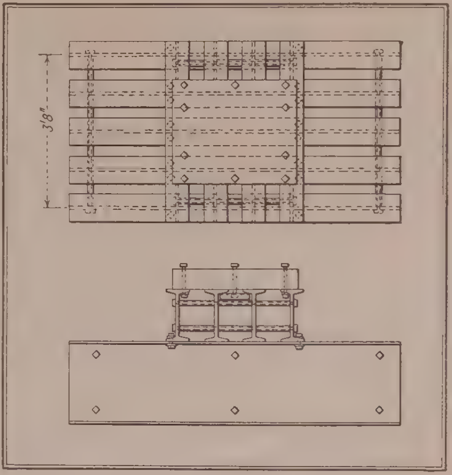
GENERAL LAYOUT

The general plan of the subway track layout at this point has already been described in the Engineering Record of Aug. 28, 1915, page 255, in the article illustrating the construction methods used in connecting the new work to the old tunnel. The accompanying plan of the corner of the Grand Union Hotel lot indicates the position of subway bents, columns and grillages. The building columns are to be spaced 20 ft. 7 in. on centers parallel to Forty-second Street and 21 ft. 6 in. on centers parallel to Park Avenue. The half diagonal length between columns in the direction of the subways is thus nearly 15 ft., a very convenient distance between subway bents, giving three 5-ft. panels for the side-wall beams.

As shown on the accompanying plan view, the building columns are carried at various points of the transverse bents of the subway structure, requiring a separate design for the girders of each bent, owing to the varying relative position of the columns above and below the girders, the lower columns being spaced according to the clearance requirements for the four tracks of the subway.

ASSUMED DESIGN LOADS

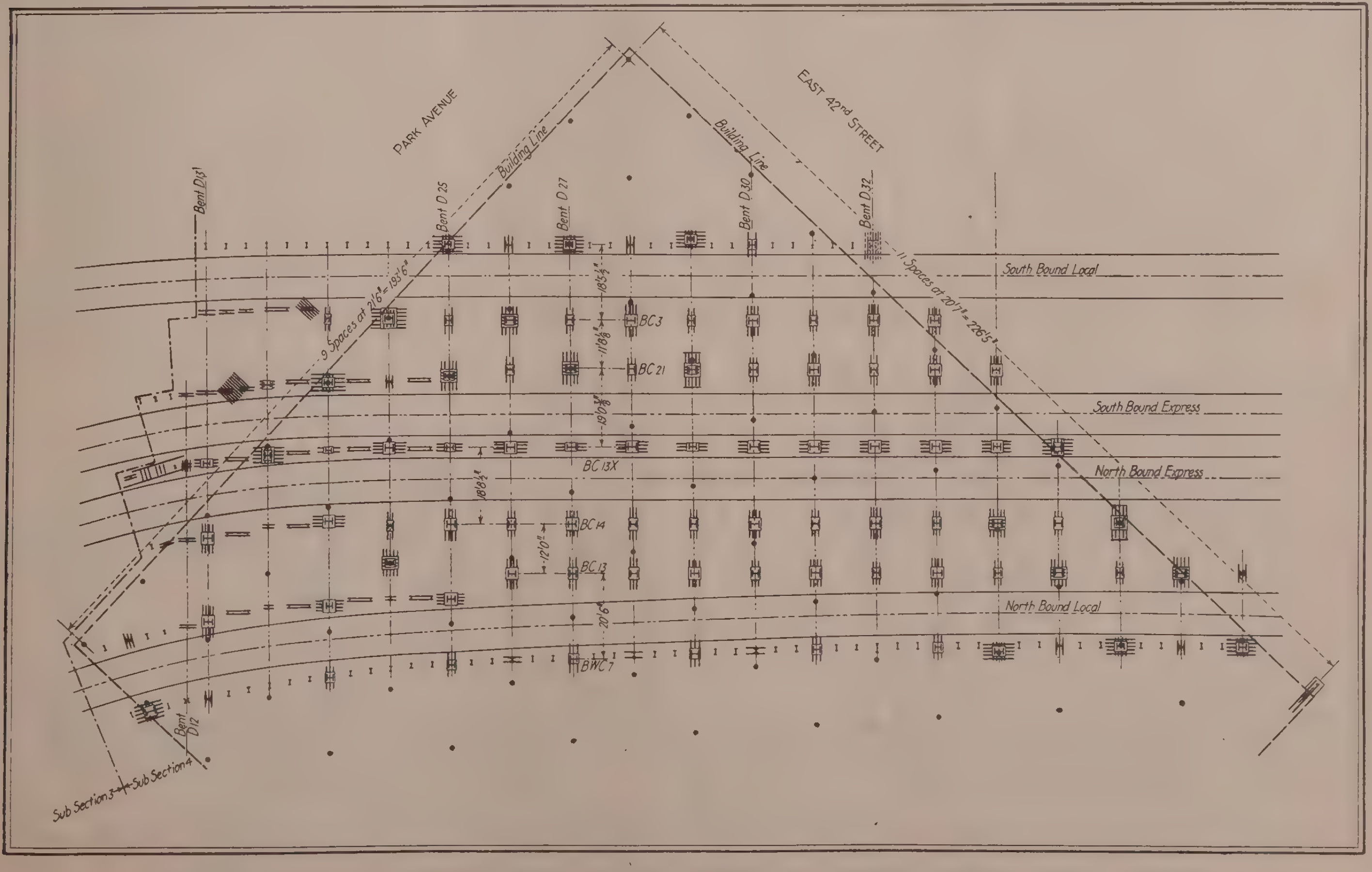
In addition to the dead load of the structure itself, the cross girders of the bents were designed for two possible cases of loading. Case 1, as noted on the accompanying drawing of a typical bent, D27, provides for a future office building which may be at least twenty-five stories high. Case 2, for bents D25 to D30, provides for a temporary backfill 28 ft. deep assumed at 100 lb. per cu. ft., giving a uniform loading on the subway roof of 2800 lb. per sq. ft., amounting to 200,000-lb. concentrations at the connections of the longitudinal beams spaced on 5-ft. centers, as noted.



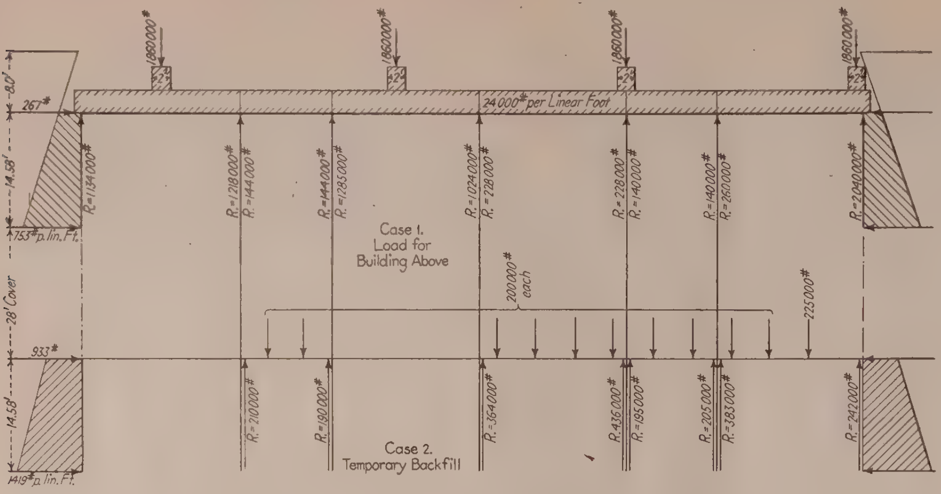
TYPICAL DETAILS OF COLUMN GRILLAGE

In providing for the future office building (assumed to be designed according to the New York building code before the recent revision) the average dead load per floor was taken at 125 lb. per sq. ft., including the weight of partitions and columns. This dead load with the prescribed percentages of the specified live loads will give the total column concentrations of 1,860,000 lb. for interior columns, as noted on the drawing. The exterior column loads are 2,134,000 lb. for the columns along Park Avenue and 2,082,000 lb. along Forty-second Street, the weight of outside walls increasing the load carried by these columns.

In addition to the column concentrations, provision is made in Case 1 for a direct



FOUNDATION PLAN OF GRILLAGES FOR SUBWAY COLUMNS INDICATES THE LOCATION OF FUTURE BUILDING COLUMNS



TWO CASES ASSUMED IN DESIGN OF BENTS—LOADS GIVEN FOR TYPICAL BENT

basement load or basement load and fill varying, according to the depth of the latter, from 500 to 1200 lb. per sq. ft. The load of 24,000 lb. per linear ft. on bent D27 is a combination of this load and the weight of the subway roof.

TYPICAL BENT DETAILS

The accompanying detail drawing of a typical bent, D27, indicates the heavy framing, columns and foundation grillages required in this construction. The concrete piers, specified to be carried down to sound rock, in some cases where a seam of jointed rock was encountered had to be made deeper than is indicated by the drawings. Grillages are the usual steel I-beam type, embedded in concrete.

Heavy steel slabs under the columns transfer loads to the grillage beams, and it will be noted that in some cases the top of the column carries heavy steel slabs to receive the future building columns. The sizes of steel slabs specified are based upon rolled or sawed edges, and it is provided that if they are sheared hot, 1 in. must be added to the dimensions each way to secure the net bearing required.

The depths of the cross girders vary, as is shown on the drawing, those girders carrying building columns near their centers being increased in depth for economy.

The design was made by the engineering staff of the New York Public Service Commission for the First District, of which Alfred Craven is chief engineer; Robert Ridgway, engineer of subway construction; D. L. Turner, deputy engineer of subway construction; Sverre Dahm, principal assistant engineer; A. I. Raisman, senior designing engineer, and C. E. Conover, designing engineer in direct charge. The steel was fabricated by the American Bridge Company, subcontractor for the Rapid Transit Subway Construction Company, contractor.

Crooked Highways Straightened

When the present highway department of King County, Washington, was organized and plans for conducting its work were laid out, it was decided to relocate certain crooked roads which had developed, little by little, as the territory had built up. It was found possible to effect a considerable amount of grade and curvature reduction by modern location methods. The old road between Auburn and Enumclaw, a distance of 18 miles, was found to have a maximum grade of 12 per cent. By relocating this line a distance of 4 miles was saved and the new line replaced a grade ¾ mile long in which there had been a total of 2000 deg. of curvature. The relocated line on this grade had only 250 deg. of curvature. South of Seattle the old main road to Auburn has been relocated, and in a distance of 3½ miles the total curvature is being reduced from 1650 to 450 deg. The line is being shortened by ½ mile.

Stoplog Barrier Regulates Romanov Canal

Intake at Main Diversion Channel of Russian Irrigation System in Eastern Turkestan Requires No Dam

By LOUIS ROSS

Civil Engineer, San Francisco

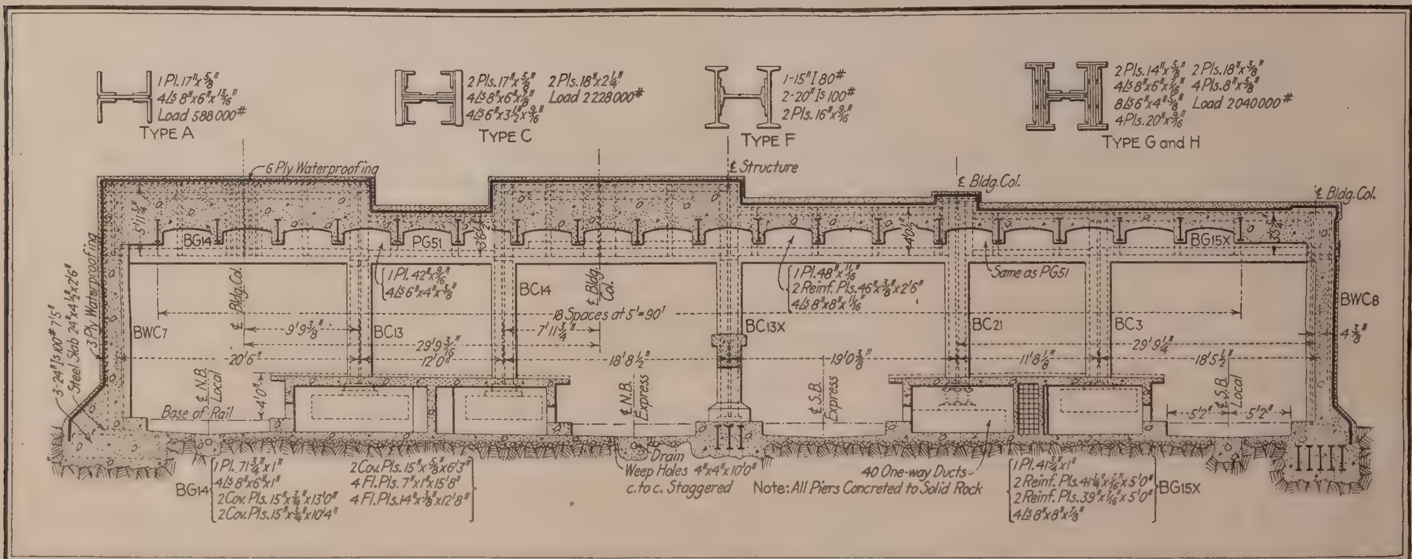
A STOPLOG barrier regulates the intake of the Romanov irrigation canal in eastern Turkestan, keeping out silt by admitting surface water only. The stoplogs are operated by a winch, handled under normal conditions by one laborer. A feature of the works is that no dam was required.

The Romanov canal is the main diversion channel of the irrigation system now being built by the Russian Government to supply water to Hungry Desert in eastern Turkestan from the River Syr-Daria. The canal is now being constructed for a capacity of 1700 sec.-ft., and is to provide water for the first unit of 130,000 acres; but provision is made for enlarging to a canal capacity of 4000 or 5000 sec.-ft. and supplying 400,000 acres. In working out the design the irrigation of the entire 2,000,000-acre area of the desert has also been considered as an ultimate possibility.

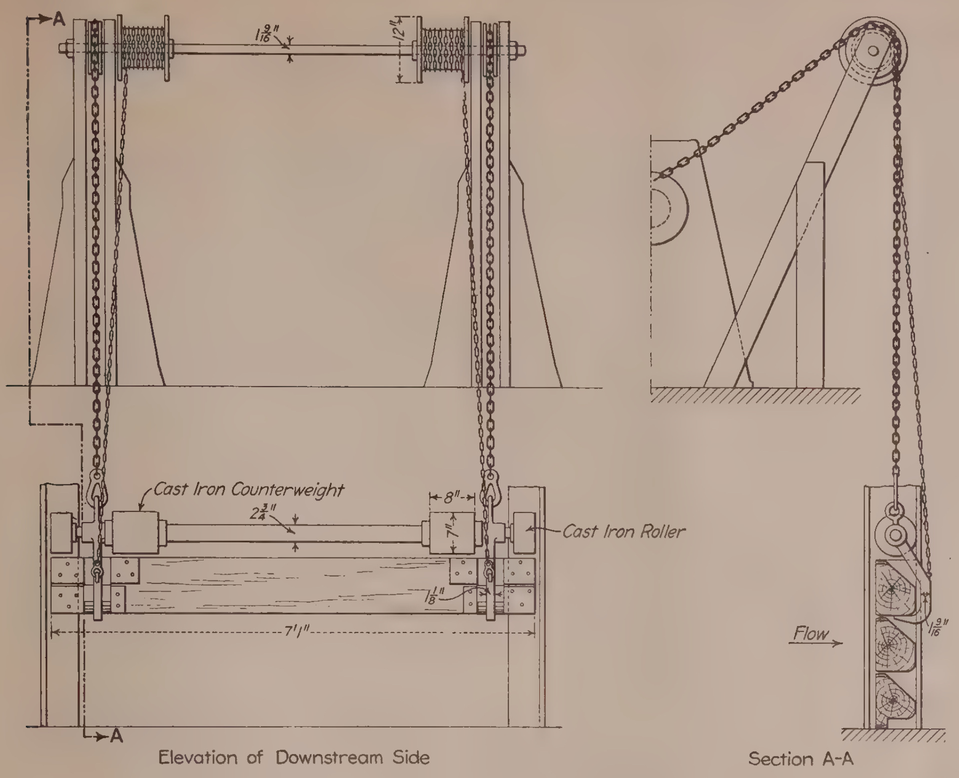
WATER DIVERTED WITHOUT A DAM

A peculiar feature of the project is that water is diverted from the river without the use of any dam or other obstruction to the stream. The Department of Agricultural Improvements rejected plans for a dam in 1897 because of the storm of protests and doubts which the suggestion evoked, and after some deliberation it was decided to construct the intake in such a way that the water supply would be constant, independent of any diversion structure. Accordingly, the headworks are located at a point where the shores and bottom of the river consist of a substantial conglomerate not liable to serious washouts, and the sill of the intake was placed 8 ft. below the lowest water level on record.

The headworks, which consist of a granite structure founded on concrete, parallel the direction of the current for a length of 200 ft. and have fifteen arched openings for admitting water to the canal. These openings, each with an area of about 6½x9 ft., are separated by 3½-ft. piers. The masonry work, which is built of the best cut granite.



DETAILS OF TYPICAL BENT D27 SUPPORTING BASEMENT LOADING AND COLUMNS FOR TWENTY-FIVE STORY BUILDING



Elevation of Downstream Side

Section A-A

WEIGHTED HOOKS FOR GRAPPLING STOPLOGS

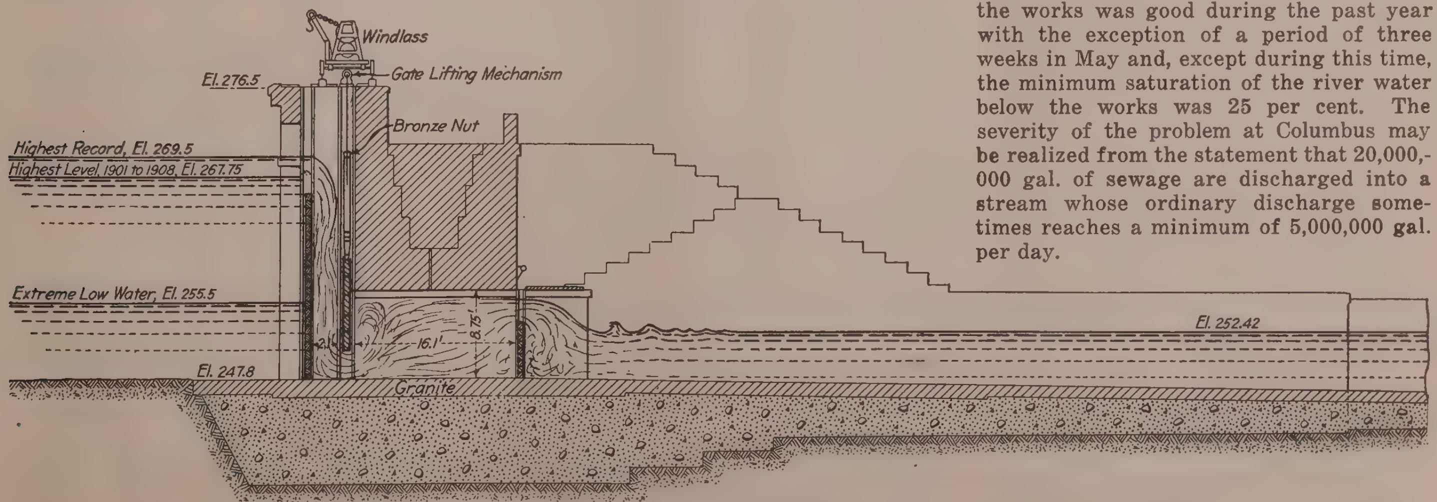
has a total height of 30 ft. above the sills, so that there is no danger of river freshets overflowing into the canal at this point. The accompanying section of the headworks shows the massive type of construction adopted and the recorded water-level fluctuations.

DEVICES FOR CONTROLLING FLOW

Owing to the large amount of silt carried by the Syr-Daria, and in order to reduce scour effects, a stoplog barrier was used so that only surface water was admitted to the canal. These stoplogs are 7 x 10 in. in section, 7 ft. long, and are braced against metal-lined guides. Behind the stoplogs, closure of the canal opening is effected by iron sluice gates sliding on cast-iron guides. A means of dissipating the kinetic energy of the inflowing water was provided by a second set of stoplogs, placed in the canal behind the metal sluice gates so as to retain a volume of water to act as a cushion.

The stoplogs nearest the river were located as close to the metal gate valve as possible, so as to reduce the cost of piers and to permit a combination of operating mechanisms. These stoplogs are handled by the hand winch shown in the sectional view, which is equipped with a pair of chains and grabhooks, as shown in the detail drawing. The combined friction and weight of water on each stoplog requires a maximum lifting force of 2300 lb., and the winch was designed on this basis. To assist in lowering the stoplogs and properly to space and direct the grabhooks, an iron bar or spreader is attached to the low ends of the chains and is provided with iron cylinders, which bring the total weight of the unit being lowered up to 400 lb. When lowering the stoplogs, if there is any tendency to catch or stick, the chains are repeatedly drawn taut and then suddenly released so that the weighted bar strikes light blows on the stoplog, tending to force it downward. The ends of the stoplogs are shod with iron to minimize friction and to provide a firm hold for the hooks. The 45-deg. chamfer is to guide the hooks so that they will engage properly.

The winch is designed to be operated by one laborer, but when the metal weights are used to strike blows on the stoplogs in lowering, four laborers are required. The windlass is also arranged for operating a trash rack which normally rests on top of the stoplogs. The metal sluice gate is also operated with the winch by means of a wormgear and brass nut. The stoplogs retaining the water cushion are handled by a grabhook device similar to that already described, but operated by a wormgear.


Windlass
El. 276.5
Gate Lifting Mechanism
Bronze Nut
Highest Record, El. 269.5
Highest Level, 1901 to 1908, El. 267.75
Extreme Low Water, El. 255.5
2'
16.1'
8.75'
El. 247.8
Granite
El. 252.42

SECTION THROUGH ROMANOV CANAL HEADWORKS, SHOWING POSITION OF THE GATE-LIFTING MECHANISM

HEADWORKS TESTED

The headworks were first tested out in September, 1913, and up to March, 1914, the mechanism is reported to have operated very satisfactorily, with no trouble from silt or drift. It is to be noted that this design is similar to that introduced by the United States Reclamation Service on the Laguna dam, but in that case the depth of water was only 9 ft., against the 22-ft. height in the present instance.

The headworks on the Romanov canal were designed by A. Kursish, civil engineer, Tashkent, Asiatic Russia, from whose report this description has been translated and condensed.

River Inspection Real Test of Sewage Treatment

The purpose of the sewage treatment plant at Columbus, Ohio, is to keep the Scioto River in a reasonably clean condition. To obtain data on this point the scope of the river inspection work has been constantly enlarged during the last four years. The two prime considerations in river inspection work, according to C. B. Hoover, chemist in charge, are as follows: The results of the inspection constitute a record of the existing conditions, and the possibility of the correlation of stream data and analytical data on the treated sewage whereby the sufficiency of the treatment may be predetermined.

In 1912 the temperature and dissolved oxygen of the river water were taken at various points. The amount of the per cent of saturation with oxygen was computed. Gradually the amount of data taken was increased. In 1915 eight additional observations and determinations were made as follows: Dissolved oxygen consumed after one day at 37 deg. C.; presence of odor, color, gasification, floating material, sludge deposits; development of odor in river water after incubation for two days at 37 deg. C.; stability value by methylene blue test of river water at 37 deg. C.

The condition of the Scioto River below the works was good during the past year with the exception of a period of three weeks in May and, except during this time, the minimum saturation of the river water below the works was 25 per cent. The severity of the problem at Columbus may be realized from the statement that 20,000,000 gal. of sewage are discharged into a stream whose ordinary discharge sometimes reaches a minimum of 5,000,000 gal. per day.

Literature

For the Civil Engineer and Contractor

New Publications

Port of Seattle Commission. Fourth Annual Report. Year Ending Dec. 31, 1915. Paper, 6 x 9¼ in.; 93 pages; illustrated. Seattle, Wash., Mechanics Publishing Company.

Reports of traffic manager, chief engineer, auditor and counsel, which include a general review of the work of the commission in the completion and operation of extensive port improvements recently put in service, together with cost data on the structures, financial statistics and a tabulation showing the extent of Seattle's water trade.

David DuBose Gaillard—A Memorial. Compiled and published by the Third U. S. Volunteer Engineers. 6 x 9 in.; 188 pages; 4 illustrations. St. Louis, Third U. S. Volunteer Engineers.

This memorial volume is published by the Third U. S. Volunteer Engineers in memory of Colonel Gaillard, who was their regimental commander during the Spanish-American War. It contains a sketch of Colonel Gaillard's life and tributes to him as a soldier and as an engineer. There are many quotations from various newspapers and magazines published on the occasion of Colonel Gaillard's death.

Books Reviewed

Value for Rate-Making

Author, the late Henry Floy, A.B., M.A., M.E., consulting engineer. Cloth, 6 x 9¼ in.; 322 pages; 4 figures; 16 tables. New York, McGraw-Hill Book Company, Inc. $4 net.

Reviewed by C. W. Stark

Associate Editor, Engineering Record

In his new book on value for rate-making Henry Floy, who barely lived to see his work off the press, has made an important contribution to valuation literature. Writers on valuation divide into two classes, according to their views of the relation of utility and public, and the two classes disagree as to the very axioms of valuation. The tenets of the one class—the state-commission side, the agency-theory side—have been ably set forth in book form within a year. As for the other class, which holds, as the reviewer does, that honest investment in public utilities must be protected, even though the public has to pay more for service, many experts have convincingly expounded its principles in societies, conferences and monographs, but to comparatively small audiences. Mr. Floy's new work, however, is the first book presenting this side of the argument that has come to the reviewer's attention since the publication, four years ago, of his earlier work, "The Valuation of Public Utility Properties"; and valuation history has been made in the last four years. The new book should have a wide sale.

Three principles are set forth in the preface, and these three show clearly the author's point of view. They are (1) that fair present value should govern, (2) that theoretical depreciation should be ignored and (3) that certain intangibles should be allowed. His first chapter is introductory and his second is devoted to definitions, which are in general excellent. In chapter 3 he takes up the fundamentals of valuation, and here he offers those of the other school ample opportunity to disagree with him. Yet the pages are replete with extracts from legal decisions in support of his views. This whole chapter of 27 pages is so meaty that it is useless to attempt to summarize it. Suffice it to say that it is based on the three principles referred to.

Chapter 4, "Fair Value for Rate-Making," is not so good. The author has explained in his preface that much matter originally prepared for other purposes has been used, and this chapter gives evidence of it. At the very start there is a half-page repetition of a passage from a court decision already quoted in chapter 3, and there are other evidences of neglect to co-ordinate this chapter with other parts of the book. There is, however, plenty of good logic in the chapter. One point urged by the author is that for efficiency in the utility there must be incentive in the way of a possibility of attractive profits.

Chapter 5 discusses reproduction cost, and leaves little to be desired—first presenting the arguments for reproduction cost new and then going into the inventory, unit prices, contractor's profit, engineering, contingencies, interest and other important details. The chapter includes a page summary of the elements of reproduction cost.

The grouping of subjects in chapters 6 and 7 is somewhat unusual. They are respectively "Land, Paving and Water Rights" and "Franchises, Working Capital and Discount," and together occupy 45 pages. Land is dismissed very briefly, the less important subject of paving is given about the same amount of space, while water rights are discussed at considerable length. Working capital is also given rather more space than appears necessary to set forth its importance.

Going value is the subject of chapter 8, and the author devotes 58 pages to it. He points out the confusion surrounding this term and discusses four meanings that have been given to it. His interpretation of it is what he calls the "comparative plant" method, which makes the figure an estimate of what it would cost to build up the business and revenue of a new plant to that of the existing plant, and not a capitalization of actual past deficits. As he says, the method is strictly a reproduction method. The reviewer is in full accord with his interpretation of the term. While at first glance it may seem that this denies recognition of actual investment, that is a reasonable investor's risk.

The final chapter is on depreciation. In his 76 pages the author applies himself mainly to his argument against any deduction from the rate base for accrued depreciation, and his arguments are sound and complete. He leaves to others the discussion of fine-spun theories for calculating such accrued depreciation, touching but lightly on the straight-line and sinking-fund methods and not mentioning the equal-annual-payment method at all—an omission that the reviewer can hardly regard as a serious one. He does, however, present a few tables that may be useful in depreciation calculations, which, of course, for the determination of depreciation reserves, have to be made as accurately as possible, considering the uncertainties of life lengths and interest rates.

All through the book is a good presentation of the utility side of the valuation controversy—not rabid, but fair. As previously suggested, those who are definitely of the other school will disagree with the author's axioms. To neutrals, however, if there are any, and to those of the Engineering Record's faith, the volume is heartily recommended.

Hydraulics

Author, R. L. Daugherty, assistant professor of hydraulics, Sibley College, Cornell University. Cloth, 6 x 9 in.; 267 pages; 245 illustrations. New York, McGraw-Hill Book Company, Inc. $2.50.

Reviewed by A. G. Hillberg

Civil and Hydraulic Engineer, New York City.

This book has been prepared for students required to study, in a general way, the subject of hydraulics and to serve as a foundation for those who intend to specialize in this branch of engineering. It therefore only "scratches the surface," and a number of important questions have been left out. On the other hand, matters of fundamental importance are explained in a thorough manner, giving the student a rational understanding of the subject. In the preface the author states that "this work has been prepared primarily to meet the needs of his classes."

The book is divided into sixteen chapters, well illustrated by diagrams, line cuts and halftones. In the chapter dealing with dams, only a few of the prevailing types are mentioned. The information conveys in a general way the principles underlying the design of gravity, framed, arched and earth dams. The use of flashboards is explained.

The application of the Kutter and Bazin formulas to other than open channels is not mentioned. In the Bazin formula the coefficients of roughness given are unfamiliar, but after having studied the matter it appears that the author has multiplied the well-known coefficients, given by Bazin, by 1.811. This deviation from well-established and well-known values tends to cause confusion.

For *R*, the hydraulic radius, the author substitutes *m*, which is the French practice and not customary in other countries.

Hydraulic machinery, such as waterwheels and centrifugal pumps, takes up about 100 pages. The theory is explained briefly, and for more extended treatment the student is referred to "Hydraulic Turbines" and "Centrifugal Pumps," two books written by the same author whose text is now under review.

The book is clearly written, and will serve admirably the purpose for which it has been published. Its value as a text and reference book for engineers, however, is doubtful, but, according to the author, the book has not been written for that class of readers.

Flood Building to Save Floors

Recent high water in the Mississippi seeped under the levee at Bettendorf, Iowa, and started to force up a 40 x 80-ft. reinforced-concrete floor of the two-story brick paint shop of the Bettendorf Company. The head was 6 ft. and the toe of the dike was 8 ft. away from the building, which rested on a slag fill. When the floor began to bow up in the middle two carloads of lead and pig iron were piled on it without effect, and to save the floor the shop was flooded to equalize the pressure.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Relation Between Yield Point and Proportional Limit

Sir: I have read with interest the discussion of "elastic limit," "proportional limit" and "yield point," in your issue of July 15, page 78. "Proportional limit" is the adaptation of "elastic limit" to practical testing, just as "yield point" was adopted years ago for the same purpose, and with identical meaning. They will continue to be indicated in practical testing by "drop of beam."

If the term "yield point" appears vague it is because it has not been understood. This, I believe, was originally "made in Germany," and its general acceptance here has simplified and clarified practical specifications. Henry B. Seaman.

New York.

High Velocity in Large Hydraulic Dredges

Sir: I note Mr. Massey's letter on the subject of "High Velocity in Large Hydraulic Dredges," published in the Engineering Record of June 17, 1916, page 810, and I trust that you will permit me to trespass a little further on your time and that of your readers.

The basis of the design of the pumping unit and pipe line of a dredge should be the character of the material, the rate at which it is to be handled and the distance to which it must be pumped. These points having been settled, we may proceed with the design, and if a well-balanced unit is to result the disadvantages as well as the advantages of a small-diameter pipe line must be considered. The data for the Toronto project are not given.

Detailed published experiments on the transportation of filter sand through pipes up to 4-in. diameter indicate that when a certain velocity is exceeded, in this case something less than 5 ft., there is no greater tendency for the sand to settle to the bottom in long pipes than in short ones. A study of such published and unpublished data as the writer has been able to obtain leads to the conclusion that there will be no tendency for sand to separate in a 20-in. dredge pipe with a 10-ft. velocity or in a 34-in. dredge pipe with a 12-ft. velocity, regardless of the length of the pipe. In all dredging operations some gravel or larger stones must be provided for, and these will settle to the bottom within a few feet of the pump, after which they may be heard to bound along the pipe at a lively rate. Judging by the sound, there is no increase in the material transported in this manner as the distance from the pump increases.

It is conceded that a higher percentage of solids can be carried with a 16-ft. velocity through a 24-in. pipe than could be carried with a 14-ft. velocity through a 27-in. pipe; but if the power required to transport the yardage through the 24-in. pipe were applied to the 27-in. pipe, the increase in volume of mixture would more than offset the loss in per cent of solids, and the yardage that could be carried by the latter would greatly exceed that carried by the former.

Taking the capacity in cubic yards per hour of a 24-in. pipe with a 16-ft. velocity as the basis, we should have the following comparison:

Advantages of a 27-In. Over a 24-In. Pipe—1. A decrease in the first cost of boilers, engine and pump.

2. A decrease in fuel bills.

3. A decrease in wear and tear on the pump.

4. A decrease in the pipe-line pressure. (In the case of the Cyclone and Tornado the usual rubber sleeves have been replaced by ball-and-socket joints. High pressures will always require stronger construction, offsetting to some extent the saving due to smaller diameter.)

Advantages of a 24-In. Over a 27-In. Pipe—5. Greater ease of handling shore pipe. (The writer has talked to several men who have had experience in handling 27-in. shore pipe, and they are unanimous in saying that there is no especial difficulty in this respect.)

6. Lower first cost of pipe line.

The writer's statement in regard to pump efficiency should have been taken literally. For slow speeds a more efficient dredge pump can be designed for a low head than for a high head. E. J. Dent,
Major, Corps of Engineers, U. S. Army.

Little Rock, Ark.

Brush-and-Stone Jetties Prove Effective

Sir: Attention is called to the very interesting paper by W. I. Risley, in your issue of June 24, on the protective works on Absecon Island which so successfully protected the portions of the beach where the hooked jetties were placed. He has given a full description of their form and cost, but has, apparently inadvertently, failed to mention that the plans which were applied were those secured by letters patent issued to the writer and were used after conference with him as consulting engineer and for which a royalty was paid by the city of Ventnor. This statement is made merely to remove the conclusion, logical from the description, that these forms are public property. They have resulted from an extended research into the intricacies of the various systems in vogue for this class of work, and which have not given entire satisfaction, or have, as stated in the article, cut off access to the beach for bathers, thus destroying one of the chief attractions of the seaside resorts.

The writer does not indorse some modifications which have been added to the "hooked jetties," in the form of the lateral spurs. They tend to check the shoreward drift of the sand and to create gullies and dangerous obstacles to bathers at high tides. Nor does he always consider stone-and-brush filling as essential, since some of the jetties built on exposed beaches at Atlantic City and Far Rockaway, composed of two rows of stockade piles, 6 ft. apart, and merely braced transversely at the upper stringers, have not only forced the low-water line out as much as 500 ft. (at the latter place) but have buried the piles, of which they are the nucleus, out of sight, thus preserving them from injury by waves or teredo.

In general, it may be said that the normal spurs which are so frequently applied in connection with vertical or inclined bulkheads are incorrectly designed, and are thus expensive and inefficient. They do not utilize the dynamic agencies available for accumulating and impounding the littoral drift, save to a very limited extent in the groins, which they form, as may be seen in many recent works along this coast where the beach has been eroded from 300 to 500 ft. in recent years and the jetties have not recovered the loss. The rapid reclamation at Ventnor has enabled the secondary low bulkheads to be erected parallel to the boardwalk, thus creating impounding basins forming sheltered pools for safe bathing and extending the beach seaward. This secondary line, however, retards the growth of the deposits, for it is stated that the vertical fill has been as much as from 4 to 6 ft. at Ventnor. The open hooked jetties have made deposits exceeding 10 ft. in depth and covering several blocks on both flanks of the work at much less cost, so that the evidence of nature should carry great weight as to the relative efficiency of the remedies to be applied.

These statements are made in the interests of the public good and are not in any wise to be regarded as adverse criticisms.

Cynwyd, Pa. Lewis M. Haupt.

[In accordance with its custom the Engineering Record submitted a copy of Mr. Haupt's letter to Mr. Risley. The latter's answer follows.—Editor.]

Sir: In reply to the letter of Lewis M. Haupt in regard to the jetties at Ventnor City, it seems that he has become somewhat confused in his dates. The Ventnor jetties were constructed during 1912 from plans prepared by the writer independently of Mr. Haupt, and it was not until the spring of 1914 that Mr. Haupt was retained as engineer for Ventnor, and then only to prepare plans and specifications for his "flying buttress." It is true that Mr. Haupt had put in a claim for infringement of his patents on the curved form of jetty, and the fee paid him for the "flying buttress" included any claim that he might have for jetties already constructed and for any jetties of this form that the city desired to build.

However, it was not intended by the writer to give the impression that the curved or "hooked jetty" was public property, but simply a recommendation of this form, as he is of the opinion, through experience with this and other types, that this is the most stable and effective form in which to construct a jetty. The greater efficiency of such jetties, however, depends upon the location selected for placing them and the combination of the forms in a system, as has been done at Ventnor and Longport.

Stone-and-brush filling is very essential for jetties on this beach, where reclamation is not so rapid as at the inlet of Atlantic City or the beaches of Far Rockaway, and the writer feels that it is the use and constant maintenance of the stone and brush that have made the Ventnor jetties so successful. W. I. Risley.

Atlantic City, N. J.

Engineers' "Right-of-Entry" Act

SIR: In the course of our practice as engineers in charge of various works for municipalities we have very often been annoyed and sometimes put to considerable trouble during the preliminary stages of the work by the unreasonable hostility of property owners and tenants who have obstructed us in the survey work. Frequently such people will absolutely refuse to permit entry to land through which it is imperative to pass in the process of making necessary surveys and examinations, and sometimes they will go the length of threatening and attempting bodily injury to those employed.

Added to the contingent worries of, say, picking out the best possible route for an outfall sewer and the proper location for a disposal works, fighting briars and mosquitoes, etc., the verbal abuse (frequently highly vitriolic) and dire threats against one's life and liberty by some irate farmer or lot owner may easily become more than a joke. Such opposition frequently takes the form of legal procedure which makes necessary endless extra work and added expense to all parties concerned.

While it is true that nearly all "enabling acts" confer the right to acquire lands and make the necessary surveys, it is often the case that surveys and examinations on the ground are necessary for the very purpose of preparing such acts themselves.

Knowing that we were not alone in such experiences and believing that engineers should at least be entitled by law to carry on their work unmolested so long as that work is not harmful to other people, we last winter drafted an act which we believe covers the situation and, with the co-operation of the Engineers' Club of Baltimore, W. W. Crosby and several of the engineers of the various departments of the state service of Maryland, had it introduced and passed by the Legislature of Maryland as Chapter 649 of the Acts of 1916.

We inclose herewith a copy of this act and would like to have your comments and those of the Engineering Record's readers thereon. It has occurred to us since the act was passed that the engineers of the various branches of the Federal Government should have been included in it. This omission was an oversight on the part of all who were interested in the enactment.

In our opinion some such law should be on the statute books of every state, thereby saving not only trouble and annoyance to the profession but often actual loss to clients. E. G. KASTENHUBER, JR.,

Of Kastenhuber & Anderson, Civil Engineers and Surveyors.

Easton, Md.

[The law, which may well serve as the inspiration of similar acts in other states, follows.—EDITOR.]

AN ACT to empower civil engineers and surveyors to enter and work upon private lands for the purpose of making surveys and examinations, for the purpose of gathering data for proposed public or municipal works or improvements thereto.

Section 1. Be it enacted by the General Assembly of Maryland: That civil engineers and surveyors, when they are in the employ of the state, or any county, or any city, town or village of the state, shall have the right to enter upon any private lands for the purpose of making surveys, running lines of levels or obtaining any needful information or data for the preparation of plans, reports or new legislation necessary for any proposed public sewerage system, waterworks, establishment of corporate boundaries or any extension of the same, highways or improvements to the same, or any public undertaking of a like nature.

Section 2. And be it further enacted: That civil engineers and surveyors when acting under the authority of this act shall have no right to damage or destroy any property or lands entered by them in the legitimate performance of their work, except that they shall have the right to set stakes, markers or monuments or other suitable landmarks or reference points where necessary.

Section 3. And be it further enacted: That no owner, occupant or agent of private lands so entered shall obstruct, impede or annoy civil engineers or surveyors or their employees in the performance of their work under this act, nor shall any such owner, occupant or agent destroy, obliterate or remove any stakes, markers, monuments or other landmarks set or placed by such civil engineers or surveyors, and any owner, occupant or agent violating the provisions of this act shall be guilty of a misdemeanor and subject to a fine of not less than twenty-five dollars ($25) nor more than one hundred dollars ($100), or to imprisonment for not less than 30 days nor more than 60 days or both at the discretion of the court.

Section 4. And be it further enacted: That this act shall take effect as from June 1, 1916.

Engineers and the New Nationalism

SIR: I have read with pleasure and profit the article by Miss Frances A. Kellor in your issue of July 1.

I have long felt that the members of the engineering profession as a class fail to appreciate how their work, and hence possible influence, ramifies through our whole social structure. Failing to recognize this fact, they have too often failed to meet their larger responsibilities.

With Miss Kellor, I hope that our work for preparedness may lead us all to a more complete acceptance of our responsibilities as citizens and members of the great human family.

I agree heartily with Miss Kellor that our engineering colleges have resting upon them a grave responsibility in this connection. A. C. HUMPHREYS,

President, Stevens Institute of Technology.

Hoboken, N. J.

SIR: I thoroughly enjoyed reading Miss Kellor's article entitled "The Engineer and the New Nationalism." It is certainly true that a great opportunity for human service resides in the profession of engineering, and I believe that engineers intrusted with problems relating to the welfare of humanity can be depended upon to respond most heartily.

New York. SPENCER MILLER.

SIR: I have read Miss Frances Kellor's article with attention, and certainly it is a very interesting one, and covers some points to which American industrial life must give consideration, as they will influence a wide field in our national future.

Undoubtedly the engineers of the country should play a very large part in the work outlined by Miss Kellor, and in many cases they undoubtedly will, and I am happy in knowing that their influence is constantly extending, but it will yet require a large amount of educational work and perhaps some rather disagreeable medicine to fully impress upon the controlling powers in industrial work the importance of giving full recognition to the engineering problems of their enterprises.

Our labor situation at this time is in a condition in many ways dissimilar to any of our past experiences and the situation of the future is a problem regarding which we can at the present time only surmise, but undoubtedly there will be absolutely new forces and new conditions to be considered and dealt with.

Miss Kellor paints a picture of the new town and the new industry, but it is not in that line alone that the greatest work must be done. It is the reorganization and reconditioning of the old industries which will bring about the quickest and the greatest results; but agitation is what brings consideration of a subject, and in that way certainly Miss Kellor's article is of great value. ROBERT W. HUNT.

Chicago, Ill.

Coast Erosion and Sea Defense

Speaking before the Institution of Municipal and County Engineers, John S. Brodie, borough engineer of Blackpool (England), presented a summary of his experiences in coast erosion and sea defense. About 10 years ago erosion on the east coast of England resulted in a demand for state assistance in the protection of shores. The agitation culminated in the appointment of a Royal Commission in 1907, and after four years spent in taking evidence and inspecting the coast lines of practically the whole of Great Britain and Ireland, the commission finally reported in 1911 that, within a period of 35 years, while 6640 acres of land had been lost to the United Kingdom by erosion, on the other hand 48,000 acres had by accretion and reclamation been gained. The commission made recommendations to Parliament, but up to the present time no legislation has been enacted.

Expert opinions on sea defense works, according to Mr. Brodie, are divided between the use of sea walls and groins. As usual, the truth of the matter is that neither is of universal application, but that each foreshore must be considered in relation to its own particular circumstances and conditions.

A sea wall may be the best protection for one particular foreshore, while groins may be the best for another, and a combination of both a sea wall and groins may be the only protection adequate for still another. But apart altogether from the adequate protection of the coast line, it must be obvious that groins are very unsightly and inconvenient on a wide sandy foreshore used for recreation purposes, and should be avoided where possible on these grounds alone. It must be further kept in mind that experience has amply shown that there are no engineering difficulties in building a sea wall which will not depend on groins to prevent it from being undermined by the sea.

The financial considerations are really the determining factors in sea defense works.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

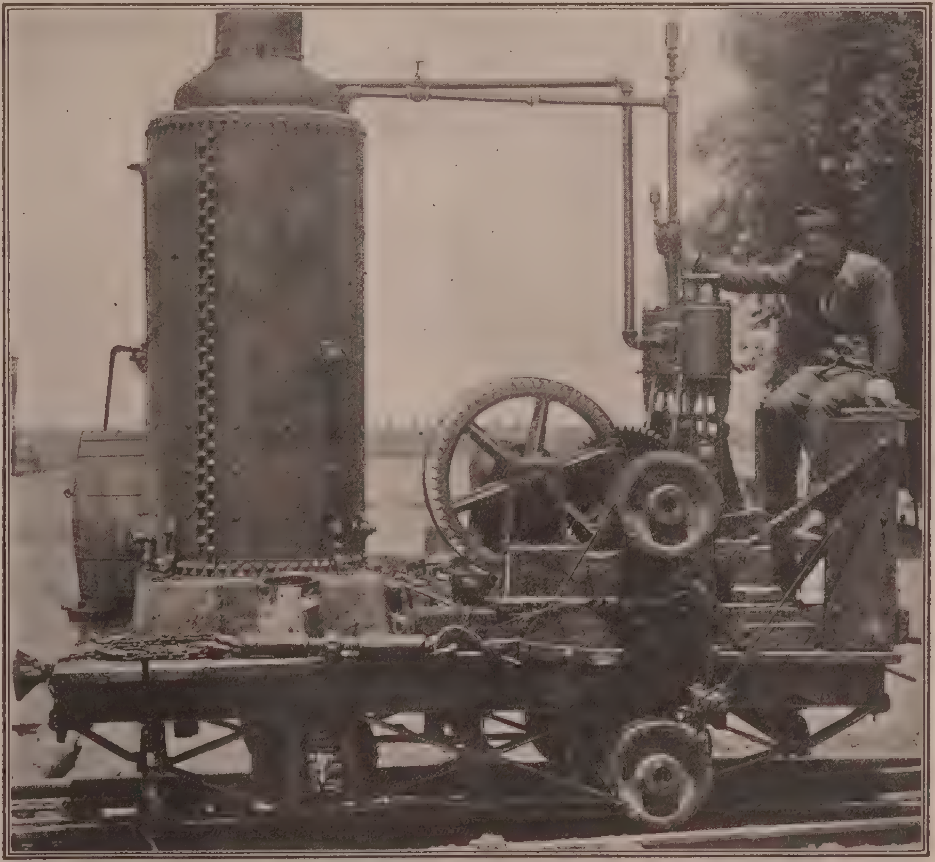
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Odds and Ends, in Hands of Master Mechanic, Make Locomotive

By R. R. RIEMENSCHNEIDER
Canton, Ohio

THE PHOTOGRAPH shows a locomotive built from odds and ends by Dick Neff, master mechanic of the E. J. Landor Company, and used for hauling dump cars of dirt. The locomotive was built right on the job to help dispose of the excavation for an addition now being constructed to the new open-hearth plant of the United Steel Company at Canton, Ohio. It is complete, even to the whistle, but the most interesting part of it is the drive gear. As may plainly be seen in the photograph, this consists of a wire-rope drive tightened on one side by a steamboat ratchet and snatch block and on the other by a small idler on the end of a heavy coil spring. The spliced length of cable is given a turn around each of two flanged wheels, whose pedigree is not disclosed, but which closely resemble traveler derrick wheels. One of these is mounted on the extra-long drum shaft and the other on an extra-long axle of the car. There are rumors that the cable splice pulled out on one occasion and that the locomotive is to be provided with a regulation chain drive. The locomotive handles two dump cars at a time, and has been successful in keeping very busy the clamshell derrick that is handling the bulk of the excavation.



Courtesy Courtney Studio, Canton, Ohio.

HOME MADE, BUT COMPLETE EVEN TO THE WHISTLE—AND IT HANDLES TWO DUMP CARS

Accounting for the Contractor: Transferring Equipment

By BENJAMIN L. LATHROP
Of Lathrop, Shea & Henwood Company,
Scranton, Pa.

SINCE the article of this series on handling equipment accounts appeared in the Engineering Record for July 8 (page 57), some inquiries and suggestions have been received in the mail which will prove of general interest, and may elicit further correspondence on the subject.

One correspondent says: "The firm for which I worked was in the habit of allowing the superintendent of the contract from which the plant was being shipped to put a value on all plant and tools except the more expensive pieces of equipment, a price on which would be sent in from the main office. The result always was that the superintendent making the shipment would charge as high a price as he thought the superintendent on the job to which the stuff was going would stand for.

"As this second superintendent figured on getting it back out of the next job to which he sent plant, he would usually accept a valuation much in excess of what the first contract was entitled to. The result was that the company was carrying a large fictitious value on its books. A much better system is used by a contractor in Pittsburgh, who does not allow men on the job to value anything. They merely send an inventory of what is being shipped, and all the charges are transferred at the main office. The inventory, of course, shows the condition of the tools, but there is not nearly so much temptation to make money on paper under this system. I thought possibly you would have an improvement on both of these to suggest in some of your articles."

Of course, the first method outlined is absurd, when no check is kept on the men who make the valuations. This piling up of paper profits not only works harm in fooling the principals of the concern into a notion that they are making more money than they really are (providing the principals are as gullible as the contractor in question evidently was), but it actually costs the contractor real dollars and cents in excess taxes on his personal property, and in case of large operations may even make him liable for an excessive income tax through failure to make proper charges for depreciation and obsolescence as allowed by the federal tax commissioners.

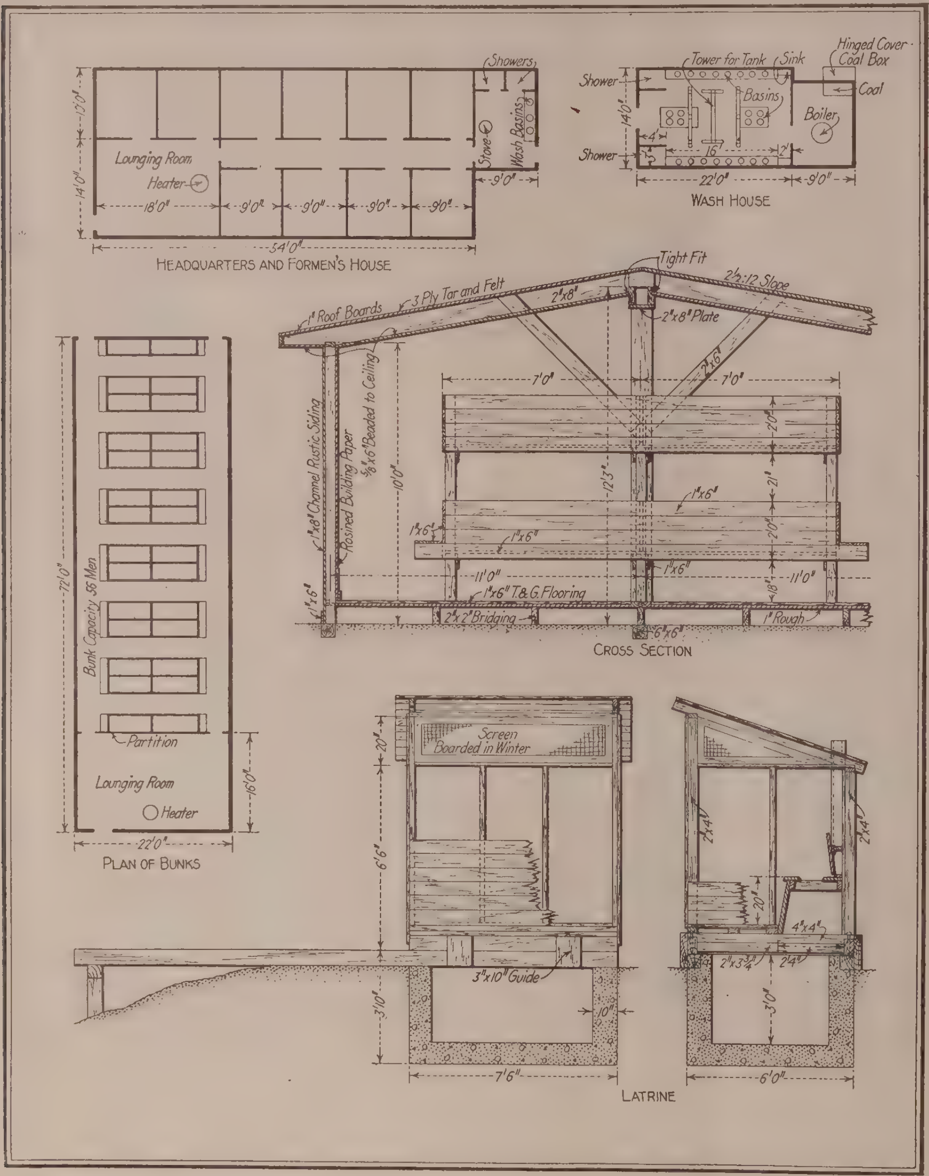
The second method is, I believe, in accord with the best practice for handling small items such as shovels, picks, crowbars, handdrills and other small tools.

Another letter contains, in reference to the transfer of equipment from one contract to another, the following:

"A friend of mine is working for a large building contractor who has solved this difficulty very neatly. This firm has a central storehouse and repair shop to which everything, down to shovels, is sent at the completion of each contract. This storehouse is run as if it were a contractor's equipment company, and all its accounts are kept separate. It charges the different contracts for exactly what it sends them, and my friend says it has made money on the books ever since it was put in, allowing only a fair valuation for the equipment and tools it rents out to the contracts. Also, everything is kept in much better shape."

At first reading this seems like an excellent suggestion, and for a contractor whose field of operations is limited to a comparatively small area it might work out very well; but its application to a big concern operating in half a dozen or more different states would be difficult. Suppose the Carter Construction Company has two steam shovels and a dragline and all the attendant equipment operating on a job in Massachusetts, a section of railroad construction in New Jersey, and a contract for the erection of an industrial plant in Connecticut. We will say that its storehouse and repair shop is located in some little town in New York where the freight connections are fairly good. The big excavation job in New York is finished, also the railroad contract in New Jersey. The plant from these two places is shipped to the central storehouse to be overhauled, and in the meantime a big piece of work is landed in Pennsylvania, and the plant in the storehouse is practically all shipped out again.

The equipment could have been overhauled and put in shape almost as economically right on the original jobs and kept there at a nominal storage cost, ready for direct reshipment to the new work. Instead, double charges have been incurred for loading, unloading and freight, and the storehouse is now practically empty and useless until, perhaps, the first of the Massachusetts jobs is finished, when the equipment is shipped into New York State for repairs and storage. Then a requisition comes in from the superintendent of one of the other jobs in Massachusetts for an additional concrete mixer, and it is shipped back from New York. It may have traveled back and forth 200 or 300 miles, when a direct shipment would have involved a freight haul of 50 miles or less; and so the illustration might be amplified ad infinitum.



DETAILS OF CAMP CONSTRUCTION THAT HAS PROVED SATISFACTORY IN COLD CLIMATE

Central Storehouse and State Taxes

The writer knows one case of a contracting corporation in—well, let us say New Jersey. It had been operating in several states, and finally picked out what seemed an ideal site for a central storage and repair plant in New York State, and as certain contracts were finished it shipped all the released plant to the storehouse. A long "slack" period followed, when comparatively little work was done, except for one singularly successful operation in the company's home state. This particular job, while it was a decided moneymaker, was a labor proposition pure and simple, involving the use of very little expensive equipment.

The great bulk of the plant was in dead storage up in that little New York town. Not a tap of work was done in the state of New York for over a year, but the company was able to declare a large dividend from its "New Jersey" operations. It had not surrendered its franchise or license to operate in New York because it wished to be in position to resume work in that state should opportunity offer. It made its regular annual report to the New York State Tax Bureau, and presently received a tax bill for the regular millage on the dividends paid on nearly 60 per cent of its total capitalization, just because it had reported nearly 60 per cent of its assets as being located within that state. Those assets had been earning nothing—had been, indeed, a source of some expense; but the New York law is fairly clear on the subject. The tax is based on a portion of the total dividends in the ratio that the capital employed within the state bears to the total capitalization, and it is assumed that the ratio of assets within the state to the total assets determines the ratio of capital employed within the state to the total capitalization. The contracting corporation advanced the argument that the assets in dead storage within the state were not "capital employed within the state," within the meaning of the law, but was overruled by the state tax department. A concession was obtained, however, because of the fact that in reporting assets within the state certain valid depreciation charges had been overlooked.

[The series of brief articles on modern accounting methods for contractors by Mr. Lathrop, of which this is the last, will be followed by another series taking up the subject of accounting in the field office—one which has been treated in the first articles only from the business point of view of the main office. The first article of the second series will appear in an early issue. —EDITOR.]

Comfortable Houses Hold Men at Construction Camp

A CONSTRUCTION camp built to furnish thoroughly comfortable living quarters in a "below-zero" climate has been provided by the Jarrett-Chambers Company for the force that is building the Lifton pumping station at Bear Lake, Idaho, described on page — of this issue. There are two houses with separate rooms, shower baths and louging rooms for the foremen and office force, lounging rooms in the four large, light bunkhouses, a central washhouse with showers and laundry tubs, two icehouses, a hospital and an incinerator.

Hot water is provided for the entire camp by a boiler located near the main tank at one end of the washhouse. All the buildings have double walls and floors, and are easily warmed by large coal heaters. A feature of the camp is the latrines, which are built on skids over concrete pits. Every week in cold weather the shelters are slid back out of the way and crude oil is poured in the pits, set on fire and the contents burned out.

Between 200 and 300 tons of ice were cut during cold weather and stored in the two icehouses for the summer, as otherwise it would be almost impossible to have ice in the camp. Ice was supplied, not only to the camp and cold-storage house, but also to the dredge boats at work on the canal. The large mess hall, with a kitchen and a small commissariat at one end, seats 300 men. The headquarters house is provided with special rooms to accommodate visitors.

Well Water for City Properties

The finance committee of the San Francisco board of supervisors proposes to sink wells on municipally owned land with a view to reducing the city's water bills. The public parks and large isolated public buildings, such as the city hospital, would be supplied from this source. The city's water bill in 1915 amounted to $210,000, it is reported, and during the coming year it is believed that additional expense will be incurred owing to the care necessary for the grounds at the civic center.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Heavy Floods Sweep Over Carolinas and Virginia

Damage Estimated at $12,000,000 Due to Worst Flood in History of North Carolina—Bridges Swept Away

Floods July 16 sweeping over North and South Carolina and Virginia are said to have caused twenty-eight deaths and damage estimated at $12,000,000. Twenty-five industrial plants have been closed at Asheville, N. C., and about 1200 men thrown out of employment. Railroads have suffered heavily and it is impossible to maintain regular train service.

The French Broad River flooded the streets of Asheville and 6 ft. of water was in the Southern Railway station at that point. Two dams at Hendersonville collapsed, but that at Lake Taxaway withstood the high water. The Southern Railway bridge over the Catawba River near Belmont, N. C., has been washed away, as has the Seaboard Air Line bridge over the same river at Mount Holly. The Dravo Power Company's dam is said to have failed July 16.

Bridges Carried Away

Five highway bridges, three in Mecklenburg County, one near Mooresville and another near Statesville, were reported washed away. Four Norfolk & Western Railway bridges on the Galax branch have been reported destroyed, as has one belonging to the Virginia & Southwestern Railway in Tennessee. Reports of the failure of the Appalachian Power Company's dams on the New River are untrue.

At Columbia, S. C., the Congaree River rose 32 ft. above its normal height. Water rose to a height of 2 ft. on the walls of the powerhouse of the Columbia Railway, Gas & Electric Company. Bags of sand were used to help repel the water and heavy 12-in. timbers braced the walls on the inside against the unusual water pressure. The plant of the Columbia Cotton Mills is almost submerged.

Dayton Engineers Will Erect New Society Building

In order to put the engineering side of life before the community two prominent engineers of that city are making possible the erection of a new home for the Engineers' Club of Dayton, Ohio. E. A. Deeds, president of the Dayton Engineering Laboratories Company, and C. F. Kettering, vice-president of the Dayton Engineering Laboratories Company, are the men. The structure will be erected at the corner of Jefferson Street and Monument Avenue on a 99 x 198-ft. plot, already purchased.

Plans have not yet been prepared by Schenck & Williams, the architects. It is stated, however, that the new building will contain a lecture hall with a seating capacity of 500. A complete technical library will also be available.

Approves Conference Report on River and Harbor Bill

By a vote of 187 to 132 the U. S. House of Representatives last week approved the conference report on the river and harbor bill. The action kills the La Follette-Clark amendment which would have prevented the Sanitary District of Chicago from taking sufficient water from Lake Michigan to handle the disposal of the city's sewage. The amendment would also have prevented the state of Illinois from building a deep waterway connecting the Great Lakes with the Mississippi River.

Begin Raising Salmon Bay to Level of Lake Union, Seattle

The mammoth gates of the Lake Washington canal locks at Seattle, Wash., dividing the salt waters of Shilshole Bay from the fresh waters of Salmon Bay, were closed at 8 a. m., July 12, and the work of filling Salmon Bay above the locks to the level of Lake Union was begun. The first link in the $5,000,000 project that will permit ships to pass into Lake Union will be completed, it is estimated by Lieut.-Col. J. B. Cavanaugh, about Aug. 1. The waters of Salmon Bay will be elevated 30 ft. above their present level at low tide. By the date mentioned the canal will be ready to receive ships of 18-ft. draft, but it will be at least two weeks later that vessels of larger size will be allowed to enter. The canal between Lake Washington and Lake Union will not be opened this year, but Lake Washington will be lowered 8 ft. to the level of Lake Union. The latter body of water is large enough to accommodate an enormous fleet.

The work of constructing the canal was begun Nov. 10, 1911. To date Congress has appropriated $2,275,000, while the State of Washington and King County have jointly added $1,000,000 toward defraying the cost. This work was described in the Engineering Record for July 31, 1915, page 141.

Engineers' Society Submits Report on Pittsburgh Subway

A report on the proposed Pittsburgh subway signed by seven prominent members of the Engineers' Society of Western Pennsylvania has been presented to the city council. It recommends the expenditure of $60,000 for location and cost surveys and for determining the necessity for a subway loop. There will probably be no further subway conferences until fall.

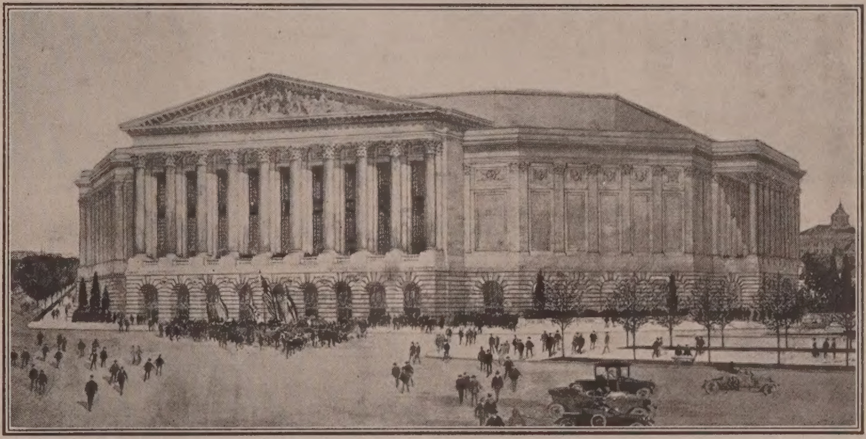
Adopt Minute Commemorative of Dr. Elmer Lawrence Corthell

Philadelphia Civil Engineers Pay Homage to Late President of American Society of Civil Engineers

The Philadelphia Association of Members of the American Society of Civil Engineers recently adopted a minute commemorative of Dr. Corthell, the late president of the American Society of Civil Engineers. A part of the appreciation reads as follows:

"Among the many who heard his stirring words when ushered to the chair upon his election to the presidency of the American Society of Civil Engineers, none could have failed to catch something of the lofty spirit of the man. His fervent appeal to American engineers to play well their part in the ultimate restoration of good feeling between members of their profession in countries now rent asunder through deadly conflict made a profound impression upon the assemblage. . . . In his informal address on this occasion, his fertile brain outlined many opportunities that lay open to the American Society of Civil Engineers for broader usefulness to the community and nation, and increased service to its members. In this he placed characteristic emphasis on the vital importance of solidarity in the profession in all relations in which the interests of engineers, as such, as members of society, were essentially identical. It was plain in his every word that he looked upon the high office for which he had been chosen not as an honor to be accepted in light spirit, but as an opportunity to give effect to some of the ideals for which he himself had labored so long and to such good purpose.

We feel that in the death of Dr. Corthell the American Society of Civil Engineers has suffered a grievous and well-nigh irreparable loss."



Philadelphia to Have New Municipal Auditorium

THE CONSTRUCTION of the Municipal Auditorium for which the people of Philadelphia voted $1,500,000 has been delayed by court proceedings since 1911. The difficulties have now been eliminated and the site selected on the Parkway between Twenty-first, Twenty-second, Hamilton and Callowhill streets. According to John T. Windrim, the architect, the structure will be 348 x 362 ft., with an auditorium 225 ft. square, capable of seating 15,000 people. Halls and committee rooms are to be provided on the upper floors. When used for exhibition purposes 91,000 sq. ft. of floor space will be available. A portico on the Parkway will support a pediment, to the apex of which from the pavement is 106 ft. The tympanum of this pediment is to be ornamented by an allegorical group of sculpture in high relief, illustrating the history of Philadelphia. A railroad siding to the north facilitates the shipment of exhibits. The Parkway will also be completed with funds recently provided.

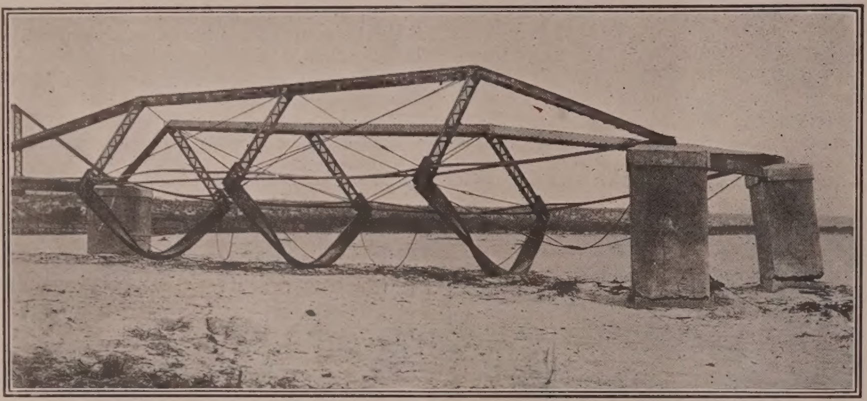
Denies Report That Power Export License Will Be Revoked

Reports that it must sell almost all the power generated at the Niagara Falls (Ontario) plant to the Ontario Hydroelectric Commission or risk the loss of its license to export power to the United States have been denied by L. F. Lovelace, secretary of the Niagara Falls (N. Y.) Power Company. The Ontario government has requested 50,000 hp. to be delivered by next December. The Canadian Niagara Power Company has offered 32,000 hp.—the amount available over the 75,000 hp. now exported to Buffalo. New generators are being installed and the Canadian company expects to meet the commission's requirements by the time specified.

Build Two Miles of Road in Forty-Eight Hours

By working continuously for forty-eight hours, the forces of the Pennsylvania Highway Department recently constructed 2 miles of road in Camp Brumbaugh, where the Pennsylvania National Guard was mobilized. The work was begun on the morning of June 30; it was completed by the following Sunday morning. Four road rollers, three traction engines and three road machines were put to work. Boulders were removed by blasting when necessary. The grading, crowning and draining followed rapidly, and in practically forty-eight hours more than 2 miles of 20-ft. road had been built. Light emulsifying oil was applied and sprinklers employed to keep the dust down.

The highway department intends to recommend an appropriation for durable highways in the camp.



Fire Destroys Bridge Across Rillito River

THE STEEL BRIDGE across the Rillito River, 4 miles north of Tucson, Ariz., was destroyed by fire late last month. The plank floor took fire from some unknown cause and the flames spread rapidly to the wood railings and trestle approach. The fire followed a dry period of several months. The effect of the heat is shown in the pictures. The structure consists of five steel spans, each 60 ft. long, with a 75-ft. trestle approach at each end. The south span, as illustrated, collapsed, breaking the concrete pier just above the stream bed. A road has been built over the dry river bed to handle traffic until the bridge is rebuilt.

This information and the pictures were supplied by A. L. Enger, assistant engineer in the Agricultural Experiment Station of the University of Arizona, Tucson.

To Investigate Changes in Laws Affecting Railroad Regulation

The U. S. House of Representatives has adopted the Newlands joint resolution already passed by the Senate. The action assures a thorough investigation of needed changes in laws affecting the regulation of railroads. The Senate Committee on Interstate Commerce and the House Committee on Interstate and Foreign Commerce are required to make the investigation through a joint sub-committee. The necessary powers for obtaining evidence have been granted. The committee is to report to Congress as soon as possible.

Approves Georgia Highway Commission Bill

The public highways committee of the Georgia House of Representatives has approved a bill creating a state highway commission. Five commissioners will be paid $10 for each day of actual service and not more than $400 a year apiece. A chief engineer will also be employed at a salary not to exceed $400 a month. The bill is a substitute for one drafted by the highway-commission committee of the Georgia Chamber of Commerce.

$70,000,000 to Enlarge Steel Plants

Eugene Grace, president of the Bethlehem Steel Company, has announced further improvements at three of the company's plants. The expenditure of $70,000,000 will be divided as follows: $30,000,000 at South Bethlehem, $30,000,000 at Sparrows Point and $10,000,000 at Steelton. Mr. Grace's announcement was made a few days after that of Charles M. Schwab, noted in last week's issue.

Report $35,000,000 Building Bill

The committee on public buildings and grounds, July 17 reported a bill to the U. S. House of Representatives appropriating $35,000,000 for new federal buildings. The measure also creates a Bureau of Public Buildings to take the place of the office of supervising architect of the treasury. The bureau will, if the measure is passed, have complete jurisdiction over the plans and construction of public buildings. It is not expected that the bill will be voted on until the next session, probably in December.

Street Cleaning Department of New York Increases Efficiency

There was especial timeliness in the presentation of the annual report of the Department of Street Cleaning of New York City just made to the Mayor by Commissioner J. T. Fetherston. Because of the importance of co-operation on the part of the department in combating the present epidemic of infantile paralysis more than ordinary interest attaches to a recital of the changes and improvements in department methods that have added to the effectiveness of its co-operation.

The report shows that co-operation between the citizens and the department has been effected and the number of complaints thereby reduced. The amount of work done was increased at a cost only slightly more than the lowest record of recent years. The area flushed daily was increased 30 per cent. A part of the report is devoted to the "model district," which was equipped with auto tractors, trailers and locomotive cranes at a cost of $112,122.

Despite the increased work handled, the numerical strength of the department and its cost of maintenance for 1914 and 1915 were about equal.

Organize Company to Study Terminal Improvements

The American International Terminal Company has been incorporated by the National City Company, the American International Corporation interests and Stone & Webster. The object of the new company is to study problems relating to railway, steamship, warehouse, and industrial terminals for the purpose of providing better facilities for the extension of the export trade of the United States.

According to W. S. Kies, vice-president, an attempt would be made to consider all of the many propositions for terminal improvements that have come up in all parts of the world, with the idea of determining upon the plan which will give the greatest efficiency at the lowest cost.

W. H. Lyford, who was long connected with a railway terminating in Chicago, has been retained as consulting expert.

$2,000,000 for Roads and Bridges in Porto Rico

The Legislature of Porto Rico at its last regular session authorized a bond issue of $2,000,000 for the construction of roads and bridges. The joint committee of both houses of the Legislature to determine the order of execution of the work has not yet been appointed. The committee will be known as the Economy Commission.

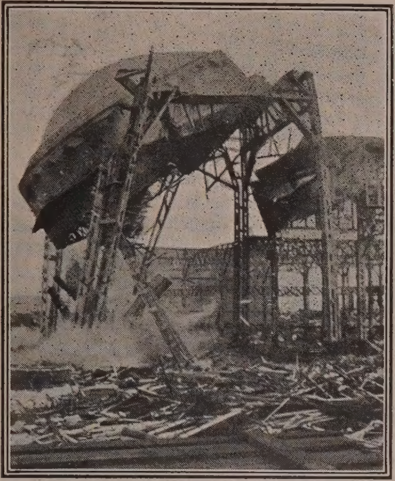
It is estimated that roads to be built in Porto Rico will involve an expenditure of about $3,000,000. While the appropriation is for only $2,000,000, roads and bridge construction included in the recently approved act will necessitate nearly $4,000,000.

Dam Bill Passed by House

The general dam bill regulating water-power development in navigable streams was passed by the U. S. House of Representatives July 14. The measure provides for a system of leases under government regulation. It is designed to induce private investment in water-power development.

Bridge Named for Major-General Meigs

The new structure spanning Rock Creek in line with Pennsylvania Avenue, Washington, D. C., will be known as Meigs bridge. It has been so named in honor of the late Maj.-Gen. Montgomery C. Meigs, who supervised the construction of the Washington aqueduct. General Meigs designed the old bridge which the new structure replaces. He also built the immense Cabin John masonry arch.



Wreck Panama-Pacific Exposition

THE WORK OF WRECKING the Panama-Pacific Exposition buildings has been done largely by using dynamite. The picture shows the dynamiting of the dome of one of the large structures.

Illinois Municipalities to Cease Polluting Fox River

Further resistance of Elgin, Aurora and other Fox River cities to the enforcement of the order of the Illinois Rivers and Lakes Commission to cease polluting the Fox River by sewage is at an end. The case entered June 19, 1914, was dismissed from the Sangamon County circuit court June 26 by voluntary agreement. This means that primary sedimentation tanks or sewage treatment of some kind must be put in service by Jan. 31, 1917.

Pipe Break Leaves Bayonne, N. J., Without Water

The breaking of a joint in a 20-in. cast-iron pipe two weeks ago to-day in the Newark meadows, noted in last week's issue, left Bayonne without a supply of water for 5½ days. C. T. Kavanaugh, Bayonne representative of the New York & New Jersey Water Company, owner of the pipe, estimates the loss of water as 25,000,000 gal. per day.

The break occurred where the pipe crosses the tracks of the Delaware, Lackawanna & Western Railroad near Kearney, N. J. The main is carried through a duct under a 4-ft. fill. It is said that the break was due to vibration caused by the railroad trains.

Future Docks in Chicago to Be of Masonry Construction

Docks built in Chicago after July 15, 1926, must be of masonry, which, of course, means concrete. The ordinance contains no specification for concrete docks, but the department of public works will draw up general plans to which all docks must conform. The commissioner of public works may refuse permits to repair present wooden docks and require their replacement where needed.

To Test Turner Flat-Slab Concrete System at Seattle

The Port of Seattle Commission, C. E. Remsberg, secretary, has instructed Chief Engineer J. R. West and Attorney C. J. France to arrange for a thorough loading test of the Bell Street warehouse. The first test made nearly a year and a half ago resulted in considerable controversy. The warehouse was built on the Turner flat-slab system of concrete construction. The designers maintain that when the first test was made the concrete was "green," and hold that the building will come up to all requirements now that the concrete has aged.

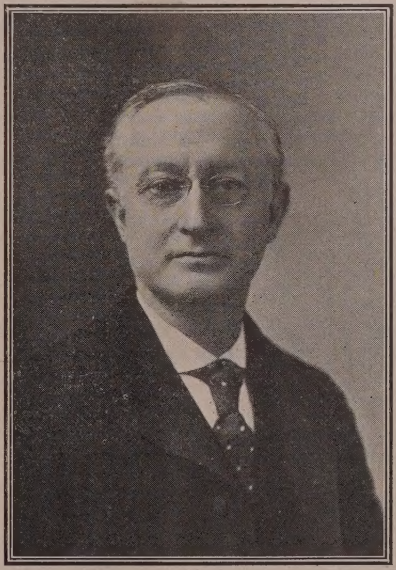
What Engineers and Contractors Are Doing

WILLIS WHITED, engineer of bridges for the highway department of Pennsylvania, has received the honorary degree of Doctor of of Engineering from the state University of Iowa. He was graduated from that institution in 1879.

HENRY W. DURHAM, engineer of Bergen County, N. J., with consulting offices in New York City, has been granted a month's furlough and returned to New York from the Mexican border. Mr. Durham is a corporal in the Seventh Regiment. His was the first leave of absence granted since the troops were mobilized.

C. FRANK ALLEN, a member of the faculty of Massachusetts Institute of Technology for the past thirty years, resigned as professor of railroad engineering July 10. Professor Allen was graduated from the Institute in 1872. For the next six years he was engaged in work connected with the water and sewerage systems of several cities including Boston and Newton, Mass., and Providence, R. I. He went west in 1878 to enter the service of the Atchison, Topeka & Santa Fe Railway. With the exception of a year spent as chief engineer of the Las Vegas, N. M., he was assistant engineer for the Santa Fe until 1885. In that year his study of law had been sufficient for him to be admitted to the bar in New Mexico. He was later (in 1901) admitted to the Massachusetts bar. Professor Allen was made assistant professor of railroad engineering at Massachusetts Institute of Technology, in 1887. He became associate professor two years later and his appointment as professor of railroad engineering followed. Among his technical books are: "Railway Curves and Embankments," "Tables for Earth Computations" and "Field and Office Tables."

Professor of Railroad Engineering of Massachusetts Institute Resigns



C. FRANK ALLEN

THE JOHN T. WALBRIDGE ENGINEERING COMPANY has removed its Chicago office to the Tower Building.

ARTHUR E. OWEN has been promoted from principal assistant engineer of the Central of New Jersey Railroad to succeed the late Joseph O. Osgood as chief engineer. Mr. Owen was educated at Rutgers Scientific School and joined the staff of the engineer of Essex County, New Jersey, in 1896. Two years later he was made draftsman for the Central of New Jersey. He was successively transitman, assistant engineer and assistant to chief engineer for that road.

RUDOLPH P. MILLER has been made chairman of the new Board of Standards and Appeals of New York City. Mr. Miller has for the past two years directed the revision of practically the entire building code of that city with the exception of sections relating to theaters. That section was recently taken up by the committee on buildings. He was made superintendent of buildings in 1910. Previous to that he had a large consulting practice in New York.

HOWARD C. BAIRD, of the firm of Boller, Hodge & Baird, consulting engineers, New York City, was recently appointed a member of the Board of Standards and Appeals of that city. Previous to becoming a member of the firm Mr. Baird was for a number of years principal assistant engineer for Boller & Hodge.

CLIFTON, APPLEGATE & TOOLE, contractors, of Spokane, have opened offices in the First National Bank Building, Missoula, Mont. The company recently secured the contract for constructing 22 miles of the extension of the Chicago, Milwaukee & St. Paul Railway up the Blackfoot River, near Missoula.

MAJOR-GEN. GEORGE W. GOETHALS', Corps of Engineers, U. S. A., resignation as governor of the Panama Canal was accepted by President Wilson July 12. The date on which General Goethals will resign has not yet been announced. He was made a member of the Isthmian Canal Commission in March, 1907, and governor of the Canal Zone in 1914.

HARRY J. CORCORAN, who was graduated from the State University of Iowa last month, is now employed as inspector of rivers and harbors at Grand Rapids, Mich.

LEWIS F. MOODY has resigned as professor of hydraulic engineering at Rensselaer Polytechnic Institute. He has been a member of the faculty of that institution for the past eight years, first as professor of mechanical engineering and then as head of the hydraulic engineering department. Professor Moody will devote his time to the I. P. Morris Company as consulting engineer.

P. H. NASH, formerly division engineer for the J. B. McCrary Company on the Lake County (Florida) highway construction, has been transferred to Shelby, N. C. From that point he will direct the construction of asphaltic concrete pavements as supervising engineer.

R. B. MURDOCK was recently made assistant engineer in the Oregon State Highway Department. He will have charge of surveys to be made for highway work in Coos County, for which $362,000 was recently voted. Mr. Murdock was previously roadmaster of Coos County.

F. H. CRAMER, formerly designer in the bridge department of the Chicago, Burlington & Quincy Railroad, succeeds A. Engh as office engineer of that department.

W. J. COLLIER, of Harrisburg, Pa., has been made engineer at the Steelton plant of the Penn Mary Steel Company.

G. A. HAGGANDER, formerly assistant bridge engineer of the Chicago, Burlington & Quincy, lines east of the Missouri River, with office at Chicago, has been made bridge engineer of the whole system, succeeding C. H. Cartlidge, deceased.

A. ENGH will succeed G. A. Haggander as assistant bridge engineer of the Chicago, Burlington & Quincy, lines east of the Missouri River. Mr. Engh was first employed on engineering work in 1904 by Ralph Modjeski, at Chicago. He went to the American Bridge Company early in the following year and in August, 1905, joined the bridge department of the Chicago, Burlington & Quincy Railroad. He was made office engineer for the Paducah & Illinois Railroad in 1914, reporting to C. H. Cartlidge, who was then chief engineer. He was appointed to a similar position with the Burlington early in 1915.

REINHARD HEEREN, civil engineer in the bridge and construction department of the Penn Mary Steel Company's Steelton plant, has become associated with the engineering and sales department of the Bethlehem Steel Company.

RICHARD M. KREUTZ, civil engineer in the bridge and construction department Penn Mary Steel Company plant at Steelton, has become associated with the Bethlehem Steel Company's engineering force at Bethlehem, Pa.

F. A. IRVINE was recently made city engineer of Jamestown, N. Y., and not of Titusville, Pa., as stated in the July 1 issue.

R. C. BRIGGS, who resigned from the U. S. Coast and Geodetic Survey in February of this year, has completed his studies at Stanford University. He is again with the Survey at Wrangell, Alaska.

F. W. CARTER will, Sept. 1, dissolve the Carter Contracting & Hauling Company, Seattle, Wash. He will continue in the contracting business as successor to the corporation.

THOMAS G. BUSH, formerly assistant highway commissioner of the State of Washington, has organized Thomas G. Bush & Company, Spokane, Wash., contractors. Before his appointment to the highway commission in 1915 Mr. Bush was manager of F. T. Crowe & Company, Spokane, a firm engaged in selling cement and contractors' equipment.

EDWARD I. CLAWITER has resigned as engineer in charge of the Southern division of Miller & Lux to become engineer for the San Francisco Bridge Company. For two years following his graduation from the Van Der Naillen School of England in 1903 he was assistant city engineer of Manila, P. I. In 1905 he was made chief engineer for the Atlantic, Gulf & Pacific Company, engineers and contractors, at Manila, having charge of harbor improvements. He was made engineer and assistant superintendent of the Atlantic, Gulf & Pacific Company of New York four years later. After a year in New York he went to the J. G. White Company, Limited, as assistant engineer at Buenos Aires, Argentina. He returned to the United States in 1911 as a member of the Hampson-Fielding Engineering Company, Denver, Col. His appointment with Miller & Lux followed.

J. W. FITZGERALD, formerly assistant superintendent of the Western division of the Southern Pacific Railway, at Oakland, Cal., has been made superintendent of the Tucson division, succeeding T. H. Williams.

T. H. WILLIAMS, superintendent of the Tucson division of the Southern Pacific, has been transferred to the Western division, with headquarters at Oakland, Cal.

G. F. NICHOLSON, district engineer for the port commission's east waterway terminals, Seattle, will, July 31, become acting chief engineer of the Seattle Port Commission, to succeed Judson R. West. Mr. Nicholson assisted Paul P. Whitham, former chief engineer of the port commission, in the general lay-out of the Port of Seattle's public terminal system and has been connected with the port since its organization. Previous to that he assisted V. G. Bogue, consulting engineer of New York City, in laying out the harbors of Tacoma, Grays Harbor and Prince Rupert, B. C. Mr. Nicholson is a graduate of the Rose Polytechnic Institute's mechanical engineering department and a post-graduate of its civil engineering department.

GEORGE P. CLAY, an inspector in the Pennsylvania Highway Department, has been made superintendent of Erie County. Mr. Clay has been with the highway department for ten years, rising from chairman to the superintendency of Erie County.

B. B. WEINBERG has been promoted from inspector in the Pennsylvania Highway Department to superintendent of Blair and Cambria counties. He is a graduate of Pennsylvania State College and became connected with the highway department in 1913.

LOUIS L. TRIBUS, of Tribus & Massa, New York City, has been retained as engineering adviser by the residents of Staten Island, New York City, in the legal warfare between them and the contractors to whom the Department of Street Cleaning for Manhattan, Bronx and Brooklyn has awarded the contract for reducing 2000 or more tons of garbage per day. The contractors propose to erect the plant on Staten Island.

MAJOR HARRY BURGESS, Corps of Engineers, U. S. A., has been transferred from Nashville, Tenn., where for the past 4½ years he has had charge of the Nashville and Tennessee Districts, to the Detroit engineering district. Major Burgess relieves Col. Mason M. Patrick, who has taken command of the Second Battalion of Engineers.

NORTON, BIRD & WHITMAN, consulting engineers, Chicago and Baltimore, have begun the publication of a monthly letter on rate-making, valuation and allied public-utility subjects for distribution among their clients and correspondents. It will summarize and comment on commission rulings. The firm is composed of William J. Norton, Paul P. Bird, formerly smoke inspector of Chicago, and Ezra B. Whitman, formerly water engineer of Baltimore.

A. K. WEBSTER resigned recently from the drafting and designing department of the Illinois Central Railroad to become sales engineer in the Chicago office of the American Radiator Company. Mr. Webster has been employed by the Illinois Central since his graduation from the College of Civil Engineering at Cornell University in 1914. At present he is studying in the American Radiator Company's Institute of Thermal Research at Buffalo.

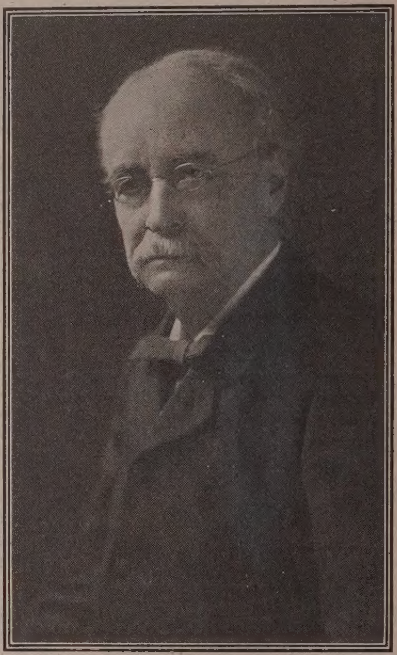
FRANK C. WORBS was recently appointed assistant engineer for the Wheeling & Lake Erie Railroad at Cleveland.

LYMAN H. CAMPBELL has been promoted from a position in the operating department of the Baltimore & Ohio Railroad to trainmaster of the Chicago division, with office at Garrett, Ind. Following his graduation from Yale University in 1913, Mr. Campbell spent four months at the Massachusetts Institute of Technology. He entered the service of the Baltimore & Ohio in January, 1914, and has since been employed in different departments, studying engineering administration, advertising and the solicitation of traffic.

Obituary Notes

DON JUAN WHITTEMORE, consulting engineer to the Chicago, Milwaukee & St. Paul Railway and past-president of the American Society of Civil Engineers, died in Milwaukee July 16 at the age of 86. For sixty-three years he was connected with the same road, resigning in 1910 as chief engineer after holding that position for forty-seven years. Upon his resignation the position of consulting engineer was created for him in honor of the character and length of his service. His latest achievement, undertaken when he was 77 years old, was the building of the Chicago, Milwaukee & Puget Sound Railway, for which he was chief engineer as far west as Butte, Mont. Mr. Whittemore was born at Milton, Vt., in 1830. After a short course at Bakersfield Academy he entered railway service in 1847 as a member of the engineering corps of the Vermont & Canada Railroad. He soon rose to the position of assistant to the chief engineer in charge of construction. Upon completion of the road he was placed in charge of a division of the Great Western Railway of Canada. He went to the Central Ohio Railroad as contractor's engineer on construction in 1852, but remained in the employ of that company only a little more than a year. Four years as assistant to the chief engineer of the La Crosse & Milwaukee Railroad led to his appointment as chief engineer and director of the Southern Minnesota Railroad in 1857. He resigned in 1860 and went to Cuba. During the winter of that year he was chief assistant to the chief engineer of the Ferrocarril Del Oeste. He returned to the United States in the spring of 1861 and took up the duties of chief assistant to the chief engineer of the La Crosse & Milwaukee. When that road was merged with the Chicago, Milwaukee & St. Paul in 1863 he was made chief engineer. Mr. Whittemore was a pioneer in the American cement industry. His experiments in 1874, demonstrating the value of limestone for the manufacture of hydraulic cement, led to the organization of the Milwaukee Portland Cement Company. He was also one of the founders of the Western Portland Cement Company. He has been a member of the American Society of Civil Engineers since 1872 and was elected its president in 1884. His name also appears in the membership lists of the American Society of Mechanical Engineers and of the Institution of Civil Engineers of Great Britain. The Western Society of Engineers claims him as an honorary member.

Consulting Engineer of Chicago, Milwaukee & St. Paul Railway Dies



DON JUAN WHITTEMORE

Good Roads Money Allotted According to Area, Population and Mileage

The method of distribution of the money recently appropriated by Congress for good roads is in proportion to the area, post-roads mileage and population of each state. The figures given in columns 10 and 11 of the table on page 42 of this journal for July 8 are therefore wrong.

A change made after the bill's introduction in Congress provides that three per cent of the total amount is to be set aside for administration of the Washington office. The balance is divided into three equal parts, each to be divided according to the population, area and post-road mileage of each state.